THE JOURNAL OF GAS LIGHTING
WATER SUPPLY & SANITARY IMPROVEMENT

VOL. LXXI. No. 1824.] LONDON, APRIL 26, 1898. [50TH YEAR. PRICE 6d.

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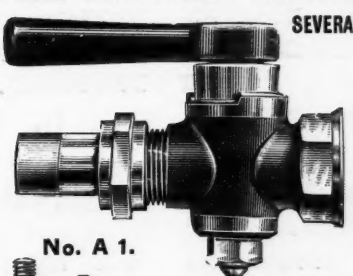

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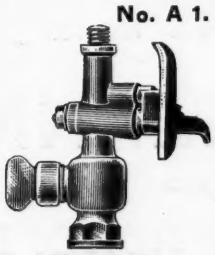

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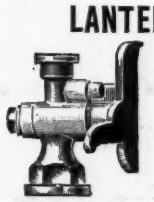

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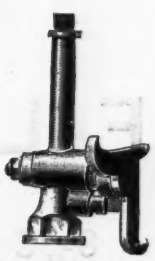

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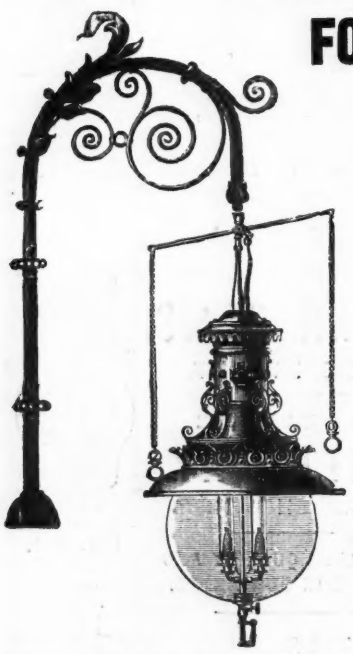

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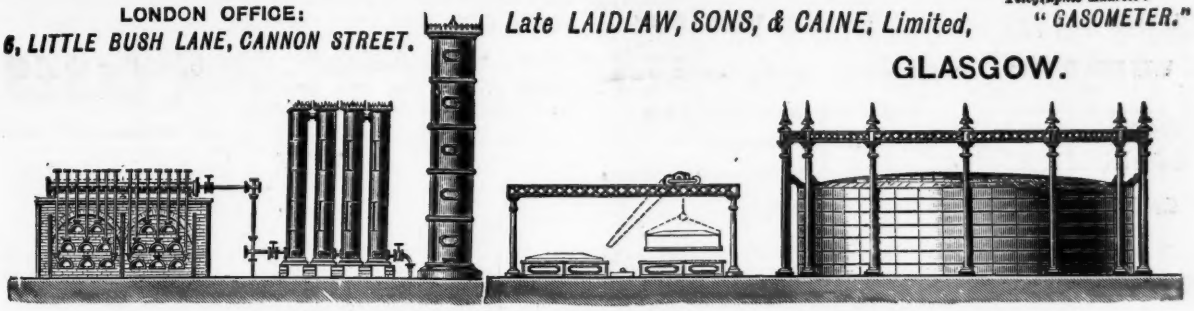

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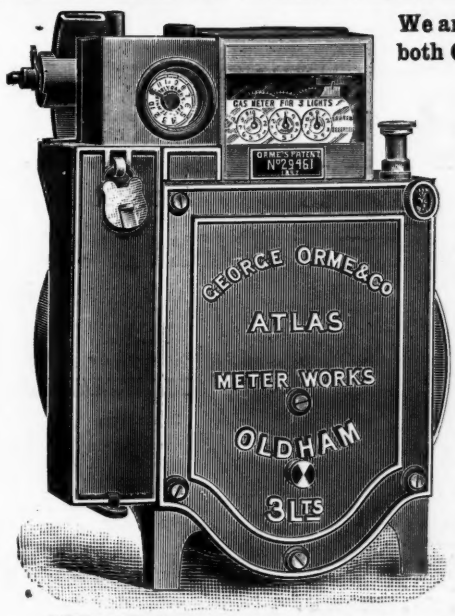

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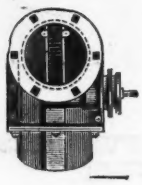

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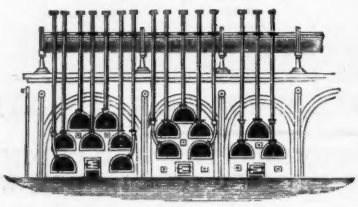

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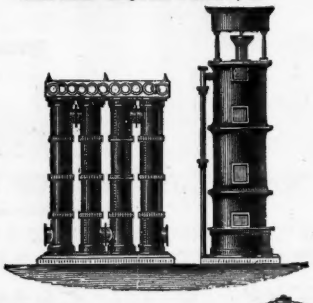

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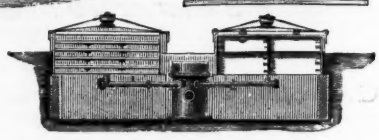

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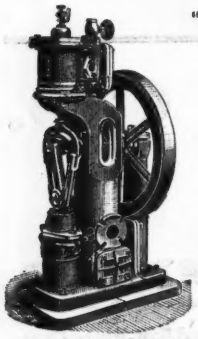

Fig. 705. "SINGLE RAM" STEAM-PUMP.

Fig. 598. "CORNISH" STEAM-PUMP FOR BOILER FEEDING, &c.

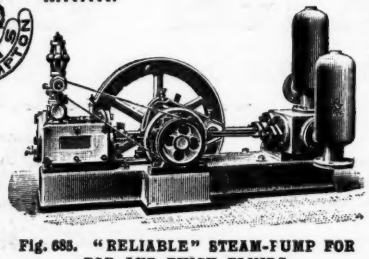

Fig. 685. "RELIABLE" STEAM-PUMP FOR TAR AND THICK FLUIDS.

Fig. 712 "DOUBLE-RAM" STEAM-PUMP.

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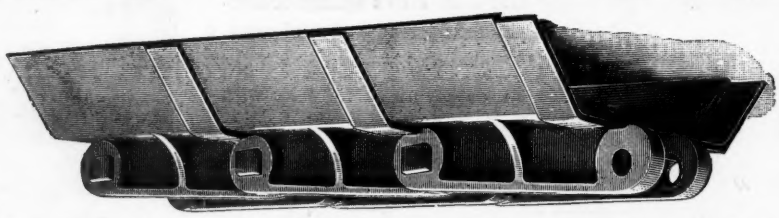

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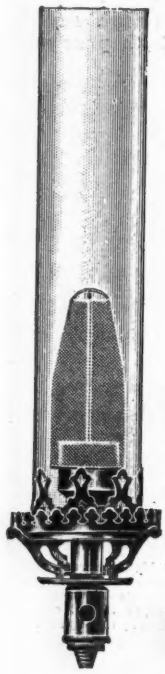

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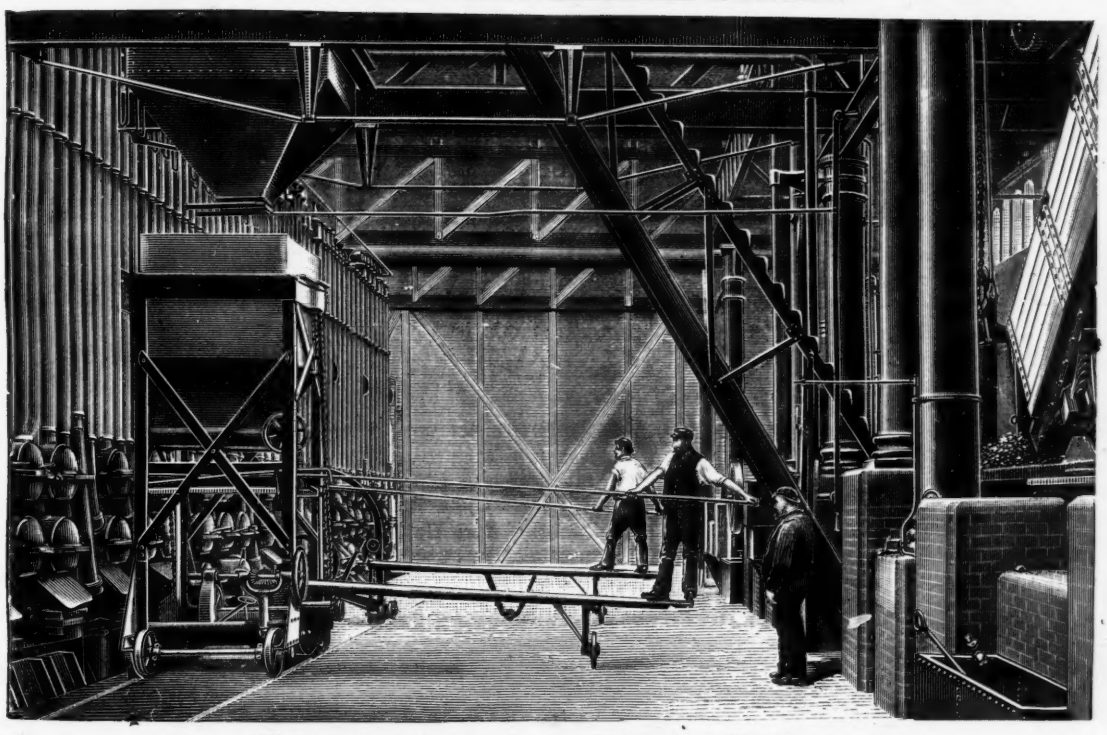

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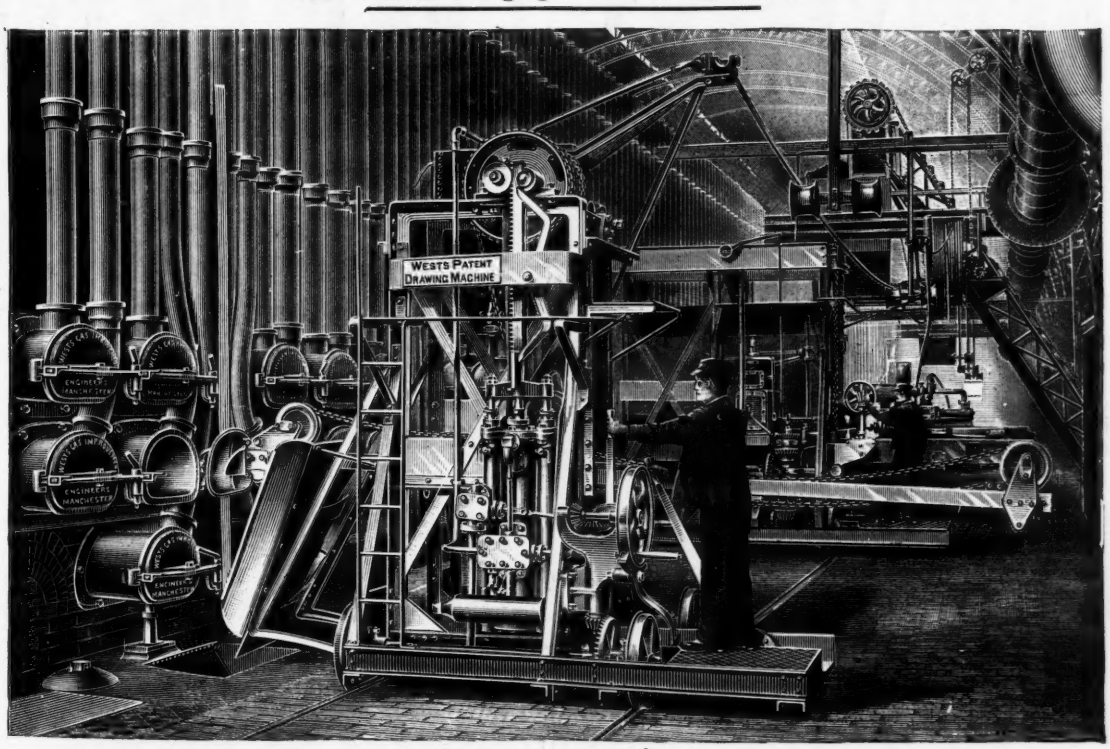

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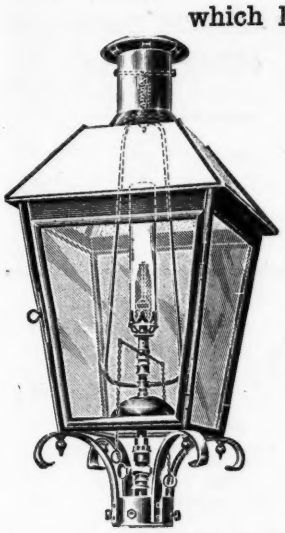
INCANDESCENT GAS-LIGHT

(Welsbach System),

which has now been successfully adapted to the purposes of



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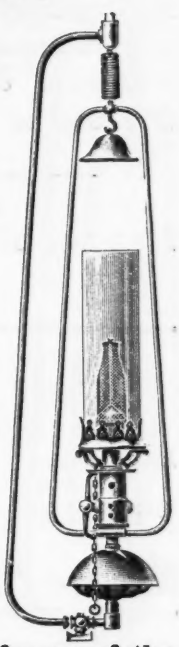

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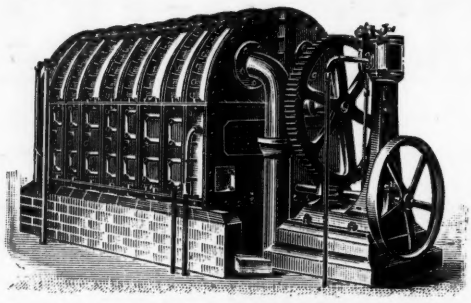

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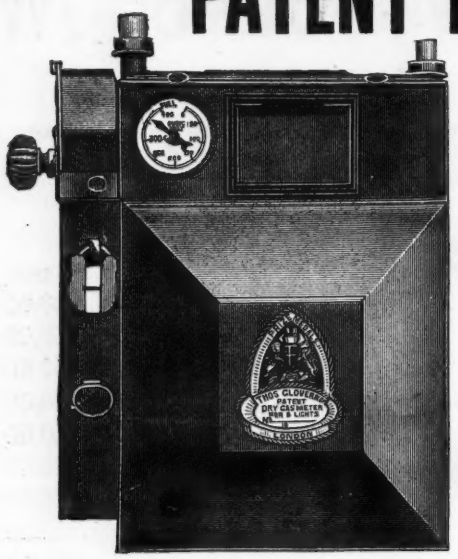

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EDITORIAL NOTES.

The Affairs of The Gaslight and Coke Company.

IT is greatly to be deplored that Colonel Makins, and through him the other Directors of The Gaslight and Coke Company, should have adopted the view that the impeachment of the administration and management of the undertaking, for which Mr. George Livesey has made himself responsible, can be disposed of by treating it as merely a personal squabble between the Chairman of the South Metropolitan and the Governor and General Manager of the Chartered Company. In one sense it is a personal matter, inasmuch as somebody had to "bell the cat;" and Mr. Livesey was the only person qualified for the thorough performance of the task. There are, notoriously, circumstances in the history of the relations subsisting for the past fifteen years between the respective autocracies of the Horseferry and Old Kent Roads, which can be alleged in support of the pretension that Mr. Livesey's last criticism of the former establishment is a piece of rancour. Colonel Makins says that this is so; Mr. Livesey says it is not. The general and the technical public, so far as the points of the main question have become common property, do not care one straw for Mr. Livesey's motives. All that Colonel Makins can impute in this regard, and all his laboured attempts to drag the main issue down to a question of testing-stations, or asphalte pavements, or what not, are the merest trifling. We are not going to offer the slightest comment on the particular development of the controversy—or what it is sought to make into a mere controversy—between Mr. Livesey and Colonel Makins. The main issues raised by Mr. Livesey, and still further condensed by a correspondent, "G. T.," in our last issue, stand precisely as they were before the "Reply" signed by Colonel Makins appeared. Another phase of the question altogether is dealt with in the letter of Mr. Fred. A. White, given in our "Correspondence" columns to-day. Mr. Livesey charges the Chartered administration and management with incompetence, and points to results for proof. Mr. White accuses the Horseferry Road establishment of arrogance and arbitrary dealing with customers capable of resenting what they regard as an over-reaching policy. Upon all these grave charges, it is idle to expect accusers and accused to come to one mind. Who is to decide between them? Theoretically, of course, it should be the proprietors of the undertaking who should judge between their agents and the detractors of the latter. Practically, there is no means of arriving at an effective judgment from such a quarter. The situation is almost hopeless. The general meetings at the Horseferry Road are of no practical account as a check upon the management. Outside agitation, provoked by an increased price of gas, is more likely to go wrong than right. Parliament has neither the opportunity nor the power to interpose for the settlement in a particular case of trouble of a kind which besets all joint-stock enterprise. Of one thing we are assured—that nothing but harm can come of a protracted "altercation," as Mr. C. E. Jones terms it, upon motives and matters of opinion, more or less bearing upon the real question, in our own columns or elsewhere. Let us have as many facts as can be adduced, by all means, upon which opinions may be based; but inasmuch as the final decision must be framed elsewhere, we shall neither anticipate nor permit correspondents to prejudice it. Individuals bulk largely for the moment in connection with this trouble; but the interests at stake are greater than they, if some of them could only realize the truth.

Justice North's Decision in the Swansea Case—Gas Companies and the Borough Funds Act.

IT will be seen by the report which appears in another column that the Swansea Corporation have, by a majority of five, adopted a report presented by their Parliamentary Committee, wherein the opinion is expressed that the decision recently given by Mr. Justice North, in regard to the payment of the costs of the opposition to the Gas Company's Bill, is open to considerable doubt; and that it is proposed, subject to advice of Counsel, to take steps with the view to an appeal. The decision in question, as our readers may remember, was to the effect that a condition precedent to defraying the costs of opposing a Bill out of the borough fund is compliance with the provisions of section 4 of the Borough Funds Act; one of such provisions being that the consent of the owners and ratepayers

of the borough concerned should be obtained, and expressed by resolution, as provided by the Local Government Act, 1858. Mr. Justice North stated emphatically (*ante*, p. 724) that at Swansea the "necessary preliminaries "had not been complied with in any way;" and that therefore no expenditure on the opposition out of the borough fund was justified. The Committee regard his Lordship's judgment as being "prejudicial in the ex- "treme to the interests of Municipalities." Moreover, they say it is quite impracticable, and often impossible, apart altogether from the expense, to comply with the provisions of the Act in time to oppose a Bill. This is a matter we need not discuss here. There is the law; and though possibly a great many well-meaning people may hold an opinion with regard to it very similar to that expressed in language more forcible than refined by a certain world-renowned parochial official, it is generally acknowledged that, like another well-known character in fiction, it "must "be obeyed." These worthy folks seem to imagine that, when conformity to the law interferes with the accomplishment of some object they have in view, they should be allowed to disregard their statutory obligations, or that the law should be amended. We do not for a moment class the members of the Swansea Committee among the number; at the same time they record, apparently with gratification, the fact that "steps are now being, and "have for many years been, taken by the Association of "Municipal Corporations to obtain an alteration of the "law" in regard to the matter in question.

We are aware that evidences of the existence of the movement referred to by the Committee have been furnished by the introduction for several sessions of a Bill to amend the Borough Funds Act. Last year it was brought in by Sir Albert Rollit, Sir John Leng, Mr. Bigham, and Mr. Whiteley on the fourth day of the session. It was proposed to facilitate the promotion or opposition of any Bills in Parliament by Local Authorities by dispensing with polls of the electorate, unless not less than one-twentieth of the number demanded such an appeal. In calling our readers' attention to this proposal at the time, we characterized it as an insult to the common sense of the Legislature to make a pretence of keeping these proceedings of Local Authorities under the control of the electors, while setting up the requirement that at least 5 per cent. of their number must co-operate for the invocation of this power of control. It may be presumed that the Bill was among the "innocents" of last session; but though massacred then it has now come to life again, though in "another place." We do not say the two things had any real connection, but it was a coincidence that no sooner did the Swansea Gas Company show their intention of applying for an injunction against the Corporation than the Bill was resuscitated—its scope being extended to Ireland—and introduced into the House of Lords by Earl Beauchamp; and, curiously enough, it was ordered to be printed on the very day that Mr. Justice North delivered his judgment. A copy of the Bill—which, apart from its extended scope, is on all-fours with that upon which an opinion was expressed in these columns last year—was promptly forwarded to us by Mr. Thornton Andrews, the Engineer and Secretary of the Swansea Gas Company, accompanied by a letter which appeared in the "JOURNAL" a fortnight ago.

In the letter above alluded to, Mr. Andrews emphasized the fact that, so long as the law remains as at present, corporations and similar governing bodies will be compelled to obtain the ratepayers' consent to oppositions such as that against which his Company had been compelled to defend themselves; and he pointed out that the increasing tendency to municipalize all local enterprise as soon as it pays, "makes it all the more important that Gas and "Water Companies should continue to enjoy the safeguard "which the Borough Funds Act gives them." Mr. Andrews thought the Bill should be opposed, as a matter of principle, by every Gas and Water Company in the kingdom. With the view of securing cohesion on this subject among gas men, and others interested in gas affairs, he suggested that a meeting should be held in London; and, in the event of the idea being entertained, he undertook to make the necessary arrangements. As far as we can learn, the proposal has not excited the interest which one might suppose the importance of the subject would have aroused. It may be thought that no opposition to the Bill is needed, as it is sure to share the fate of its predecessors; or possibly steps are being taken in individual cases. We venture to think such a course is not the right one. Municipalization is now very much in evidence—it is, in fact, an element of the "time- "spirit;" and a prominent line in the "program" of century-end Progressives is the application of the principle to gas and water works. It behoves those who are responsible for such undertakings, therefore, to be on the alert against insidious attacks. This assuredly is a case in which the magnitude of the interests at stake calls for united action; but the lines which it is to take can only be settled in conference. It is for this reason that we remind our readers of Mr. Andrews' proposal, in the hope that it may evoke some expression of opinion as to its practical value.

Meeting of the Eastern Counties Association—The Standardizing of Meter-Unions.

FOR the second time under the new arrangement, the members of the Eastern Counties Gas Managers' Association met on Wednesday for their spring meeting at Peterborough; and though an official appointment prevented Mr. E. C. Sayer, the Corporation Gas Inspector of Ipswich, attending to contribute the paper which formed the principal item of the programme, the proceedings were anything but dull, or disappointing in quality. Fortunately at their head the Association had a man who is equal to an exigency of this kind; and, not for the first time, the President (Mr. J. T. Jolliffe, of Ipswich) was able to free the Committee from what might otherwise have been an embarrassing situation. This was the last public appearance of Mr. Jolliffe as the President—at all events for a period. Previous to his acceptance of office eighteen months ago, there were unmistakable indications of a growing flagging of interest on the part of members; and a strong hand was required to steer things into their proper course. Occupying the leading position in the profession in the Eastern Counties, respected by all, and moreover resourceful, a better man than Mr. Jolliffe could not have been found for the task; and if, after all his efforts, there is not a revival of activity on the side of the ordinary members, it will be to their own discredit. Mr. Jolliffe is succeeded in office by Mr. W. D. Child, of Romford; and he will, it is hoped, in due course be followed by Mr. H. Wimhurst, of Sleaford—both of whom have done sufficient in connection with the work of the Association to command the support of the members in maintaining the organization at the level it has been left at by the retiring President.

After the transaction of the routine business on Wednesday, the attention of the members was invited to the paper prepared by the President to fill the breach occasioned by the absence of Mr. Sayer. It dealt with public lighting by incandescent gas-burners; summing up in a general manner the President's successful experiences at Ipswich. The subject was vigorously discussed by several gentlemen who have, either voluntarily or by force of circumstances, adopted this system for street lighting. One point above all others was clearly demonstrated, and it was that, to attain perfection in street incandescent gas lighting, all refractory lamps must receive individual attention—the cause of defects, especially of excessive vibration and destruction of mantles, must be discovered, and the remedy applied. If this is done, Mr. Jolliffe's experience enables him to assert, failure need not be known under any condition.

The next matter to receive consideration was the communication from the North British Association, asking for the appointment of a deputation from the Association to take part in a conference on the subject of the standardizing of meter-unions. The proposal, as our readers are aware, has recently been under the notice of, and favourably entertained by, the Midland and Waverley Associations. The discussion of the question, however, at the Eastern Counties meeting gained some distinction by the declarations made on behalf of a few representative firms of meter makers. The desirability of standardizing meter-unions is generally accepted by gas managers; but in certain quarters there has been a mistaken notion that the meter manufacturers were antagonistic to reform in this direction. It is thirty years since uniformity was first of all suggested; and the question has been resuscitated from time to time. Looking up the history of the matter, we fail to find that the meter makers have shown any great disinclination to agree to the proposed regulation of their connections; on the contrary, there is evidence of a desire on the part of the leading firms to meet the views of their customers in this respect. The failure to secure the end

sought has been due to the want of combined action throughout the country; and therefore the proposed conference of representatives of the various District Associations is a proper move. But the natural sequence would be a further conference between the Association delegates and representatives of the meter manufacturers, as it is clear from statements that were made at the meeting last Wednesday, and reported elsewhere, that it only requires co-operation between buyers and suppliers to secure a result which will be satisfactory to all concerned.

The Affairs of the Paris Gas Company.

THE annual accounts of the Paris Gas Company are usually of interest, both for the sake of the important organization to which they relate, and also as an indication of the state of the gas industry on the Continent. The most salient feature of this year's statement of the Directors (an abstract translation of which appears in another column) is the falling off in the output of gas. Although small in amount, the fact is evidently regarded as calling for a detailed explanation from the Directors, which is accordingly offered. There has been no "seasonable" weather in Paris, any more than in this country; and the gas consumption has therefore suffered. The day consumption, however, has increased satisfactorily; which shows that gas is coming more and more into use as a necessary of life in the French capital. Moreover, the number of consumers on the books continues to grow at a rate which is more than satisfactory—it is truly to be characterized as remarkable. During the last three years, the total number of consumers has been increased by nearly one-fourth part of the number previously on the books. We say advisedly that this result "has been" brought about, to indicate that it is an effect that has resulted from the carrying out of a definite line of policy by the administration, and is not merely an "unearned "increment." Four or five years ago, a new spirit seems to have inspired the councils of the Directors, who then broke away from the hide-bound tradition which is apt to gather round these concessionary gas undertakings, and adopted a popularizing policy for which their Treaty made no provision. They readjusted their business methods with their consumers; recognizing, practically for the first time, that gas, even in Paris, ought to be the poor man's means of lighting and cooking, and making it available as such. Napoleon the Third once boasted—not justifiably, by the way—that he "understood his epoch." With far more reason, the present administration of the Paris Gas Company might claim to understand their position and its responsibilities to the population of the French capital. Deprived, by the terms of their preposterous Treaty, of the ordinary commercial method of commending their chief product to the public—by reducing the price—the Directors have fallen back upon various indirect ways of benefiting their customers and strengthening their hold upon the public. In so doing, they are perhaps acting more conformably with the nature of French commercial developments in general than would have been a more direct and exclusive attention to the actual selling price of gas. France is a country of indirect taxation, and, for the time being at any rate, of reaction against Free Trade principles. The French people appear to be quite content to pay more than the actual value of most commodities, provided they get something else into the bargain. Thus the Paris Gas Company make the price of gas cover a multitude of things—not excepting one of the most benevolent schemes of employees' superannuation and so forth in existence anywhere.

The Absorption of Water by Coke.

THE old topic of the effect upon coke of exposure to the weather has again been raised in our "Correspondence" columns. We are pleased to recognize the sterling good sense of the letter of Mr. N. H. Humphrys, of Salisbury, which should go far to settle the dispute once more. Unfortunately, these problems, which ought never to be mooted at all, invariably crop up at irregular intervals of time, only to create bad blood and excite sharp language. We shall not here criticize the statement in the particular technical handbook which led to the revival of this very vexed topic. Only let this be said—and we offer the remark without meaning it as a reflection upon one book of the kind more than upon others—it is an evil when data, intended to be used in engineering and other computations of practical moment, are repeated from one book to another without anything being done to test their accuracy. Of course, such tests are not always possible; and in many cases they would involve a great deal of labour and no little expense. Moreover, it is not everybody who could be trusted to make them properly. But the difference of value between a figure or a dimension which one knows to be correct, and one that is only taken at second or third hand, is infinite. This question as to the capacity of gas coke for absorbing atmospheric moisture, is emphatically one that every gas manager—nay, every pupil or assistant in a gas manager's office—has completely within his power to settle for himself. Why, then, should he go elsewhere for the information; or why put it in a book, unless he knows all about it from the best of all sources? One has no patience with a general treatment of so concrete a problem. Nobody can possibly want to know how much water, in the abstract, coke—as a general expression—can be credited with taking up from the average atmosphere. Let the inquirer get his barrowful of coke from the retort-house or the yard, and weigh it for his own information under all the conditions in respect of which he requires to know its behaviour. An ounce of such fact is, indeed, worth any number of tons of untested bookish data. The tendency of the human mind to indulge in mythical notions concerning the nature and qualities of common things, the truth of which it is possible to ascertain by simple and obvious experiment, is one of the tritest observations of philosophy. We have to thank Mr. Humphrys for once more exploding the myth about coke absorbing up to 20 per cent. of its weight of water; but it is pretty safe to predict that in a few years the same legend will be heard of again, and from somebody who ought to know better. Of course, gas coke exposed to heavy rain or sunk in water will get wet, like most other substances in the same circumstances; but the wetting of a substance, and its power of actually absorbing and retaining water, are two different considerations. Gas coke gets very wet on the outside, because of the nature of its surface. But it is one of the characteristics of gas and oven coke, as distinguished from wood charcoal, that there is no communication between the small cavities or cells of which with their integument of carbon it is composed. Coke is, and yet is not, porous. How can water get into the inner cells? Certainly, not quickly. Actual weighings, however, are competent to settle any question of the kind. No fair dealer would object to make a reasonable allowance on the weight of coke loaded up in bad weather or from a wet place; but to talk of the absorption of a large quantity of water by coke as a regular thing is both absurd and, in a gas manager, inexcusable.

The Budget.

THE Budget was introduced in Parliament last Thursday; and, accustomed as the country is to annual statements showing its wealth and progressive prosperity, it is impossible to pass over without comment the wonderful story the Chancellor of the Exchequer had to tell on this occasion. A revenue for the past year of £106,614,000, raised without as much grumbling as used to go to the payment of less than one-half the amount, is an incontrovertible proof of the soundness of the national finances and the ability of the people to pay the taxation imposed upon them for Imperial purposes. Probably this is the only country in Europe where the fiscal authorities are not being continually exercised in devising fresh taxes which the people who pay them are not supposed to feel. The National Debt is also being reduced at a rate which is probably as rapid as is convenient or safe. The Chancellor of the Exchequer pointed out that the Local Authorities of the kingdom are increasing their own debt much faster than the National Debt is being extinguished. It is curious that the English people have almost ceased to expect substantial remissions of taxation; but this year, when this attitude of resignation to being taxed has been more marked than ever, the payers of income-tax are to get a small, but still welcome, relief. It has often been said that the professional man whose income averages about £500 a year is the most heavily-taxed of the Queen's subjects; and it is this class—among whom many readers of the "JOURNAL" might be found—who are to benefit most by the Chancellor of the Exchequer's sense of fairness. The revenue is not likely to suffer in the long run by this act of justice. We have nothing to say concerning the other proposals of the Budget. Sir William Harcourt, in commenting upon the statement, pointed out that it is essentially a Free Trade Budget. "There are

"still people," said the ex-Chancellor of the Exchequer, "who believe that the trade and prosperity of the country "is year by year going to the bad, and who tell ignorant "persons that they are being starved by the abundance of "everything and ruined by cheap commodities, and that if we "could only export everything and import nothing we should "make our fortunes." This is the sort of economic heresy which it is impossible to suppress, because it is continually breaking out in some new guise. The constant growth of national revenue is due chiefly to the fact that the industrial classes are enjoying better wages, and are therefore able to purchase more of what they regard as the comforts of life. Nor is the improvement restricted to one class; for the income-tax assessments on trades and professions have yielded an increase of 23 per cent. in the very years of the greatest fall in the prices of commodities ever known. "Fifty years ago, three-fourths of the revenue was raised "by indirect taxation, or, in other words, was contributed "by the poorer classes; but now we have arrived nearly "at equality between direct and indirect taxation." The further acceptance by Parliament, upon the invitation of the Government, of the principle of graduation as applied to the income-tax, is the most noteworthy feature of the year's Budget proceedings.

The Future of the Industrial North.

An important series of articles on the subject of the great industries carried on in the North of England has been running through "The Times" during the past few weeks. The last appeared on the 16th inst., and gave the writer's concluding observations on the fruits of an inquiry conducted with so much skill, fairness, and good taste as to constitute the whole work a credit to English journalism. We shall probably be able at no distant date to pass the articles, or some of them, in review from our own special standpoint. For the present, we only desire to draw our readers' attention to the series, and to place on record the main economic facts which the articles reveal. The first conclusion to be noted, in these days of Collectivist outcries against "starvation wages," and the denunciations of an industrial system under which "the rich "become richer, and the poor poorer," is that on the whole the great industries of the North "are maintaining "a large population in a degree of physical comfort and "well-being that compares very favourably indeed with "the state of things that prevailed a generation ago." No doubt whatever is permitted on this point by those whose memory carries them back to the early sixties. The houses of the working population are better, and better furnished; and their family incomes are usually sufficient to pay the rent and provide all the necessaries, and not a few of the luxuries, of life. The consideration that the income in question is strictly speaking a family affair, inasmuch as it is composed of the contributions of all the members of the family who have attained what is locally regarded as the wage-earning age, is a governing factor in the social and industrial economics of the region. Here arises the great question of the "half-timers," which is of the very first importance in the whole district concerned. There is a strong body of public opinion in favour of the idea that the future prosperity of the industrial North will largely depend upon the improved education of the young—education in the proper sense of the term, and not in the imperfect sense in which it has hitherto been interpreted by the elementary schools. This idea, however, cannot be carried out while the bulk of the industrial population insist on sending their children to work at the earliest age permitted by law. A source of much anxiety to those who wish well to the industrial North lies in the growing separation between the ownership of industrial property and the responsibility for the welfare of the population which ought to accompany it. Speaking of the employers and their "hands," the writer remarks that "the physical barrier of distance and the moral barrier "of totally different local associations and interests, tend "increasingly to keep apart those whose interests are in "truth essentially bound up together. And this tendency "is unfortunately much intensified by the multiplication "of limited liability companies, with their delegation, "partial even where not complete, of supervision which "used to be personal and direct." Not for the first time, the suggestion here made is that the joint-stock system, as applied to industrial concerns, tends to provoke and sustain socialistic sentiment. On the whole, the writer is hopeful of the North; but there is need of caution all round. He is doubtful whether coal mining actually pays over a considerable portion of the region, and is of opinion that any considerable disturbance of the normal working conditions—as, for instance, by the passing of a Mines (Eight Hours) Bill—"would be likely to cause the "rapid closing of the less fortunate class of pits, with the "result not only of much local loss and distress, but of a "sharp rise in coal prices, producing widespread industrial "and general inconvenience."

WATER AND SANITARY AFFAIRS.

The peculiar position of the City with regard to payment for the water supply was the subject of further exposition last week by Mr. G. P. Goldney, the City Remembrancer, who was called to continue his evidence before the Royal Commission. It has long been argued that the City paid extravagantly for water, because so little of this commodity was consumed in the highly-rated warehouses, offices, and mercantile establishments with which that part of London abounds. It is also an old complaint that the charge for water undergoes an increase in proportion to the growth of the rateable value, though there is no augmentation in the quantity of water consumed on the premises so rated. We find that the mercantile classes in the City are not made to pay for water at a rate which has been alleged to make it as dear as wine, or at least as costly as Bass's ale. The City is supplied by the New River Company; and Mr. Goldney is not aware of any instance in which the Company have raised their charge for water simply because of an increase in the rateable value. Where a building has been pulled down and rebuilt, some increase of charge may have taken place; but even then the addition has been less than the amount which the Company were legally entitled to levy. In those instances where the charge underwent revision, each case was taken on its own merits; and the terms were settled by arrangement. If rateable value ruled throughout, the City would pay a much larger sum to the Company than it actually does. Obviously this bears on the question of purchase; and we can readily understand Mr. Goldney when he says: "The basis of future charge is, from the City point "of view, one of the most important elements in con-"sidering the whole question." If rateable value is to be the basis, without modification in the mode of applying it, the charge for water in the City must rise to a common level, realizing to the full that which hitherto has only been imagined. Other highly-rated districts would suffer in like manner, though not in an equal degree. There now exists, Mr. Goldney states, a very general feeling in the City that the treatment awarded by the New River Company has been "very fair and reasonable," having regard to the power their Acts give them.

It will be remembered how loud has been the cry in the County Council that the water-rate should be made equal throughout all London. We see just now what this means for the City. All the benefit accruing from the existing arrangements settled on the merits of each case would be sacrificed. In other words, as the Chairman of the Commission interpreted Mr. Goldney's view of the matter, "if purchase took place, the City would lose "the benefit of the abatements." Supposing that the "common level" of charge throughout London still left a loss, the City would have to contribute to the rate-in-aid. Paying more for its own water supply, the City would be largely taxed—according to its rateable value—to make good the deficiency arising elsewhere. We may admire the astuteness of the London County Council, dominated, of course, by the Progressive element, in seeking to draw the Corporation into a purchase scheme, with a representation of the City to the extent of one-eighth of the statutory Committee, the seven-eighths to be furnished by the County Council. There was a time when the Corporation thought of making terms of purchase with the New River Company. They would then have ruled in their own domain, and could have settled the rates in their own way. Why the scheme fell through does not yet appear; but Mr. Goldney suggests that "perhaps there was a "little personal element in the matter." It is a bygone story; but it would be interesting to know what it means. Now all we can learn is that the Corporation are cogitating a scheme of "four Boards"—quite wonderful and elaborate

in its composition—which we venture to say is perfectly hopeless and impracticable in its nature. The principle is declared to be one of control; whereas it seems rather to consist of possession without purchase. The Companies throughout London and the outlying areas are to be arranged in four groups, and are to be dealt with in a summary fashion transcending anything yet proposed at Spring Gardens. Lord Llandaff inquired "what con-"sideration" was to be given to the grouped Companies for manipulating their charges in the manner proposed. Mr. Goldney replied: "That is the difficulty underlying "the whole question of control." But the answer only applies to the system of control which the Remembrancer had just propounded. The remark is singular which we find Mr. Goldney making immediately afterwards: "The "Committee of the Corporation have not considered "whether it would be unjust to cut down the charges." This may seem only a small matter to the Committee, but it is somewhat important to the Company, and is certainly a "difficulty underlying the whole question." But why cut down the charges, when they are already so "fair and reasonable"? What the Corporation especially dread is an "extra charge;" and they object to any terms of purchase that would involve such a burden. On this ground they demur to open arbitration, and would simply favour purchase at a price which would leave them as well off as they are.

The practical value which attaches to the bacteriological examination of water is shown by a singular controversy which appears in the columns of "The Times," set on foot by a communication "From a Correspondent." The Sanitary Authorities of Maidstone, who were not particularly alert in watching the character of the water supply prior to the late outbreak of typhoid fever, are now smitten with peculiar zeal for preventing infection through the medium of private wells. The germs of typhoid fever, it is feared, have entered the subsoil of Maidstone, and although the wells did not produce the fever, they are under suspicion as having themselves, so to speak, caught the contagion, and been thereby rendered dangerous, or at least have become liable to be infected at some future date, so as to propagate the disease. Happy were the people who drank from the wells when the public supply was infected, but they shall drink no more water from a well, if it be shown that contiguous houses have been the abode of the terrible typhoid. This seems somewhat hard on the wells, or, in other words, hard on the people whose lives were protected by the use of the well water at a time when the public supply was found to be polluted. A particular well has been made the subject of proceedings; but the Magistrates have seen fit to have a sample of the well water analyzed by the Inland Revenue Department at Somerset House. As a result, two officials in the Government laboratory have given a certificate that the use of the water obtainable from the well in question was "not likely to prove "injurious or dangerous to health." In the face of such a certificate, the Magistrates could do no other than dismiss the application for a closing order, at the same time giving costs against the Local Authority. This arouses a storm of indignation, on the ground that the Sanitary Authorities of Maidstone are prevented from doing their duty in dealing with all possible sources of danger to the public health in the area under their jurisdiction. It is acknowledged that the water from the well, so far as chemical tests go, appears to be wholesome. But it is argued that the well ought to be closed because there has been typhoid fever in the adjacent houses, and the drainage is not so good as it ought to be. The case is one of suspicion, and suspicion only. It is necessary to understand to how wide a degree such a rule may extend. If we had nothing but a chemical test to rely upon, mere suspicion would be a necessary supplement, as it has been made in the present instance. But the bacteriological test offers the means of gaining a decisive answer, so that a good water may not be condemned, nor a bad one allowed to escape. Instead of adopting this direct method, a plan is pursued by which a water is judged according to the conditions which surround it. These may or may not affect the water; and if there is to be any certainty on this point, the bacteriological test is at hand for the purpose. If Somerset House cannot apply the proper test, it is to be hoped the Local Government Board will do it. Certainly, polluted wells should not be tolerated, especially when a public supply of excellent water is flowing close at hand.

ESSAYS, COMMENTARIES, AND REVIEWS.

GAS AND WATER COMPANIES IN THE STOCK MARKET.

(For Stock and Share List, see p. 959.)

At last the war has come, and that non-combatant the Stock Exchange has been the first to suffer. The week opened badly enough—everything being highly sensitive, and ready to drop at the slightest touch; and it went from bad to worse. It was remarkable that hardly anything was weaker than the choicest gilt-edged securities, and at one time the best debenture stocks were almost unsaleable. Wild alarm about a 5 or even 6 per cent. Bank rate had much to do with this. Happily the markets were calmer before the close; and there was a little recovery in prices, especially American. However brief or however protracted the war may be, it can only end one way; the powers being so unequally matched. In the Money Market rates for discount were harder, though the Bank rate was not raised; but loans benefited by the greater abundance of free money. In the Gas Market, the aggregate of business was rather below the average; few who could afford to wait caring to sell in so distracted a time. Naturally, prices are almost uniformly lower wherever a change has occurred; and some of the best issues have suffered as much as any. Only one or two actual advances were effected. In Gaslights, the "A" remained very steady—transactions taking place every day at about 285, a little more or less. The secured issues were depressed; one debenture issue and the 10 per cent. preferences losing ground, but no business was marked in the latter. South Metropolitan was much weaker, and lost three points—changing hands as low as 132. Nothing was marked in Commercials; but the debenture was lowered three points. The Suburban and Provincial group provided the only instances of an advance in value; Alliance and Crystal Palace preference being the gainers. The Continental Companies were very quiet; but offers of Continental Union produced a sharp fall in both issues. None of the rest moved; but Bombay will reduce their rate of dividend—business having naturally suffered much from the plague. Transactions in Water were extremely limited. Like other good things, several issues have had to put up with a reduction in price.

Daily operations were: On Monday the Gas Market opened very quiet, and remained so all day. Continental Union receded 5. In Water, East London 4½ per cent. debenture fell 2. Business was rather more active on Tuesday, and prices were pretty good; but Gaslight and South Metropolitan 4 per cent. debenture dropped 1 each. Transactions on Wednesday were a little quieter; and prices were mostly steady. South Metropolitan moved down 1; but Alliance rose ½. In Water, New River and West Middlesex were 3 lower. The tendency on Thursday was downward, especially for secured stocks. Commercial debenture fell 3; Gaslight "C," "D," and "E," 2½; ditto "J," 4½; Continental Union, 5; and ditto preference, 4½. In Water, Lambeth fell 3; and Grand Junction, 1. Friday's business was very limited. South Metropolitan receded 1. Saturday was better, and prices inclined to be steadier. Crystal Palace preference rose 2; but Tuscan receded ½. In Water, Grand Junction fell 2½.

ELECTRIC LIGHTING MEMORANDA.

The Municipalization of Electricity Supply in London—Municipalism in Practice—Municipal Competition with Private Enterprise.

The adventure of the London Vestries into electric lighting is having some developments which are more interesting than agreeable to all the parties interested. As an Irishman might say, these unexpected consequences of municipal enterprise are just what one would naturally look for as time goes on. On the face of it, it seems the most harmless form of municipalism when a Metropolitan Vestry propose to supply their district, which is coterminous with the parish, with electric light. Nobody will be injured by the enterprise; and usually the parish electric lighting establishment will be such a small, harmless affair! There are two conditions of the first importance under which a London Vestry may desire to take up electric lighting—that of the absence of such a public service, as performed by a company; and, again, of the existence of a private undertaking. When the first London Vestries to go in for electric lighting started on their adventurous career, they were alone in the field. It was possible to argue in behalf of these pioneer efforts that the parishes would have little chance of getting the electric light unless they were helped to it by their Vestries. This plea held fairly good for St. Pancras, Islington, Hampstead, and Shoreditch, none of which found any competition with private enterprise in the way of their desire. The only possible rivals in the business of lighting were the Gas Company—who, of course, were not to be considered for a moment!

It was established as a principle that a Gas Company have no *locus standi* to oppose a Vestry electric light scheme generally, but only as regards their own interest in their distributing plant. The St. Pancras Vestry had not been in the electric lighting business long, however, before they found themselves at variance with the Gas Company in respect of gas getting into the electric

cable conduits. Several explosions drew attention to the fact that coal gas did get into these subterranean cavities; and then the arbitrary spirit of Municipalism showed itself in the demand of the Vestry that the Gas Company should bear the responsibility for keeping their gas out of the conduits. All the electric lighting interest of London backed up this demand; but the Board of Trade took the contrary view—that, as the conduits had been put in the way of the gas, not the gas in theirs, the new comers must take the risk of maintaining their property in a sound and safe condition. From the moment this decision was promulgated, nothing more has been heard from electricians, municipal or otherwise, concerning the iniquity of Gas Companies in permitting gas to escape into the subsoil of the streets. Recently, however, the cloven hoof of Municipalism has peeped out again in St. Pancras, in connection with the question of the location of gas-mains and electric culverts. It appears that, in pursuance of the practice they have very properly followed for many years past, The Gaslight and Coke Company proposed to lay a small service-main under the footpath of one of the thoroughfares. In former days, the proposal would have passed the Local Authority without comment, because, as a highway authority, the Vestry would have agreed that a main in this position is greatly to be preferred to one in the middle of the roadway, involving the disturbance of the latter whenever a service-pipe had to be laid or looked to. Since the Vestry have become dealers in electric lighting, however, a change has come o'er the spirit of their dream of such things. According to the report of a recent meeting of this body, as noticed in the "JOURNAL" last week, the Vestry consider that the footways of the parish should be left exclusively for the use of the Electricity Department, for supplying current to the public and private lamps; and the Vestry consider that the public should be protected "from a possible source of danger by the too close proximity of gas-mains to dwelling-houses if the mains were laid under the footways." The issue between the Vestry and the Gas Company has been further complicated by a demand of the former for the removal of all old and disused mains from the streets. It is wonderful how a little self-interest, real or imaginary, sharpens up the sanitary sensibilities of public bodies. The Gas Company do not see why everything in regard to the laying of gas-mains should be turned upside down simply because the St. Pancras Vestry want to make matters as easy as possible for their own electric lighting business; and consequently the probability is that the Board of Trade will be once more invoked to "see fair" between the conflicting interests. This is Municipalism as practised in St. Pancras.

The other condition of municipalization in electric lighting—where there is already a statutory supply in the field—has lately been the subject of correspondence in "The Times." Among the Local Authorities whose desire to undertake electric lighting has been favourably looked upon by the Board of Trade, is the Vestry of Marylebone. It is in accordance with precedent that the Board should give countenance to proposals for the municipalization of electricity supply; and also that the existence of such a supply upon one system in a given area should be no bar to the legalization of another undertaking upon a different system. But the project of admitting Vestry competition with an established supply company is something altogether new; and as there is a thriving electric lighting company already doing business in Marylebone, it is reasonably objected by the friends of the latter that a mere difference of system, even if insisted on in this case, is not sufficient justification for admitting public money to compete in the electric lighting business with private capital. The objection is well taken. A writer to "The Times" thus sums up the well-known case against competition in this class of undertakings: "In order to supply the electric light cheaply, two conditions are essential—the one is to minimize the capital expenditure, the other to keep down the working expenses. Instead of doing this, the effect of the Vestry competing would be exactly to double the capital, and nearly to double the working expenses. There would have to be erected and equipped costly generating stations; and there would have to be buried in the ground hundreds of miles of cable. The stations would be in close juxtaposition to the existing works, while the cables would have to lie side by side with the present network; the existing works and cables being already amply sufficient. Then, when all the works had been constructed, the whole of the annual working expenses, maintenance, and supervision would have to be provided for. Now, who ultimately has to pay for all this useless expenditure? Undoubtedly, the consumer will have to do so." The writer goes on to explain that it is increase of business, leading to economy of production, rather than competition which is the true explanation of the rapid reduction of the price of electricity now going on in London. The conclusion is that the protection of the consumer "consists, not in useless and expensive competition, but in the fact that every electric company is doing its utmost to produce cheaper, so that the price charged for electric light may compete successfully with gas and mineral oil. If the present Companies are only allowed to develop without ruinous competition with the Vestries, the time cannot be far distant when every householder will get this healthy light at as cheap a rate as he now pays for his gas or lamp." The latter opinion may or may not be reasonable; but it is quite certain that Vestry competition with an electric lighting company is to the full as indefensible as would be the same treatment of a gas or a water company, and is therefore to be resisted by all who have reason to dispute the encroachments of Municipalism upon the field of private enterprise.

THE EIGHT-HOUR DAY QUESTION.

WE have received from the Secretary of "The Liberty Review" Publishing Company a copy of a little book by Mr. W. J. Shaxby, the author of "The Case against Picketing," noticed in the "JOURNAL" a few months ago, entitled: "An Eight-Hours Day: The Case against Trade Union and Legislative Interference." Mr. Shaxby first of all gives a brief summary of a few of the main arguments for and against restrictive legislation as regards the hours of labour. This is followed by a short analytical statement of some of the possible and probable effects of the adoption of a working day of eight hours regarded from social, economic, and statistical standpoints. A glance is then taken at the working of some typical tentative experiments in this direction; but the author has not attempted any investigation into the conditions of success or the causes of failure. The proposals which have been made at various times are summarized; and an indication is given of the attitude assumed towards them by Trade Unions and by both employers and employed in some of the staple industries of the United Kingdom. By way of appendix, he gives such a selection of facts and quotations about the recent great engineering dispute as will form a short history of its relation to the general question. In the portion of the book dealing with Municipal and Government employment, Mr. Shaxby shows how the eight-hour system has worked in gas undertakings. It has been claimed by the Secretary of the Gas Workers' Union that more work is got through in eight hours than was formerly done in twelve; and that the majority of gas workers throughout the kingdom are working eight hours a day for better wages "on the whole." On the other hand, it has been stated by some employers that the change has been by no means an unqualified success in gas-works, either in its effect upon the quality of the work or the behaviour of the men. The increased cost of production is estimated at from 6 to 20 per cent.; and this result has been disappointing to the employers. Mr. Shaxby tells us that "the experiments appear to be proceeding satisfactorily, but whatever is the ultimate result—whether the system of reduced hours is upheld, or whether a reversion to the longer hours becomes imperative—it is clearly shown that voluntary action is, in its own way and time, finding its own solution to modern labour difficulties." Any State interference, in the author's opinion, can only result in harm. This is, in fact, his position. He states in his preface that he favours such a "voluntary reduction of the hours of labour as considerations for National prosperity and the welfare of every individual concerned will permit;" and he tells us that voluntary effort has hitherto been successful in bringing this about. If the experiment has failed, Mr. Shaxby contends that State action cannot compel success; if it has succeeded, such action is unnecessary. He considers that if employers continue to act firmly, with wisdom and in concert, the State will not be likely to trouble itself with labour legislation, but will attend to its functional concerns and ceremonials. Then the "self-appointed leaders of that Socialist faction which in the labour world makes so much noise with so little impression or real achievement," will be the only unemployed. Mr. Shaxby has produced a very readable book on an important subject.

"BURDETT" ON MUNICIPAL FINANCE.

THE publication of "Burdett's Official Intelligence"* is a useful reminder of the existence of a number of important questions of national and municipal finance which remain unsettled for a variety of reasons. The book itself is a valuable work of reference, containing as it does in a succinct form a mass of information respecting British, American, and Foreign securities of all kinds known to the London market, and dealt in on the principal exchanges. Besides this matter, the author on his own responsibility offers some exceedingly pertinent observations on various aspects of financing. It seems only fitting, as an acknowledgment of the services thus rendered to investors by Sir Henry Burdett for seventeen years past, that we should commend to the attention of our readers his latest performance of the kind; for it is the last of the series for which Sir Henry will be personally responsible, he having, as all the world knows, retired from the position of Secretary to the Share and Loan Department of the Stock Exchange. The period covered by his official experience has witnessed an enormous development of financial organization and enterprise. Stocks, shares, and debentures have multiplied and differentiated themselves into many different specific forms. The first matter of detail that the author mentions in his preface is the difference that exists between a mortgage debenture and a debenture. We wonder how many persons fairly well acquainted with the nature of

* "Burdett's Official Intelligence for 1898." By Sir Henry C. Burdett, K.C.B., (late) Secretary to the Share and Loan Department of the Stock Exchange. London: Spottiswoode and Co.; 1898.

securities of the kind could define offhand the distinctive characters of debentures, mortgage debentures, and debenture stocks? A recent case is cited, in which the Courts held that a bank can retain, against debenture-holders, the security upon which the latter have a first floating charge, providing the actual deeds constituting the charge are in the possession of the bank as security for a loan. The author remarks on this case that "it should make people very cautious before they invest their money in so-called securities which are liable to be injured materially owing to there not being a specific as opposed to a floating charge as a security for the holders." One of the objects aimed at in publishing this book is to enable investors who consult it "to acquire an accurate knowledge of the relative values and characteristics of debentures, mortgage debentures, and debenture stocks of all kinds." A good purpose, accomplished with stupendous pains and scrupulous accuracy.

It is difficult to realize the extent of business carried on by and through the Stock Exchange. Last year the total amount of all the securities admitted to quotation was £5,411,000,000 Every one of these securities had been looked into and entered upon the official list. Sir Henry Burdett draws attention to the enormous amount of work involved in this supervision. It is not, however, our present intention to discuss either the Stock Exchange or the "Official Intelligence" in its general aspects. Several articles might be written in this regard; but we shall confine our study for the time being to the author's treatment of the particular subject of the municipal and county finance of the United Kingdom. Up to the year 1885, no attempt was made to analyze the accounts of the various Corporations, or to show their financial position. In the volume for 1886 this was done for the first time; and an exhaustive review of borough accounts and municipal rating was published. "This new departure, which has ever since been kept up, entailed an immense amount of labour and research; but it greatly strengthened the book, and the facts given have had much to do with the consolidation and improvement which have taken place in regard to the financial arrangements of municipalities throughout the country."

There is a chapter of the present volume devoted to "Municipal and County Finance," which gives a general survey of the subject. It is pointed out that public interest in Corporation loans dates only from 1870, when they began to be converted into marketable securities. The rapid growth of this market is remarkable. On Jan. 1, 1882, the year in which the "Official Intelligence" was commenced, the Corporation stocks quoted amounted to only £38,427,440. On the first day of the present year, the corresponding total was £118,247,096. The latter figure represents 361 securities, created by 144 Corporations, County Councils, and other Local Authorities. This brief statement is offered as illustrating the alteration effected of late years in the financial arrangements of these authorities, "their improved methods of finance, and the resulting ease with which they are able to place their securities as and when the necessity arises for their creation." The Public Works Loans Act, 1897, is a further illustration of this. By the first section of this Act, it is provided that the Treasury may fix from time to time the rates of interest at which loans may be made on the security of the local rates out of the Local Loans Fund. The author observes that some local authorities have been exercised upon the point of whether the rate of interest charged under the Act by the Public Works Loan Commissioners is liable to fluctuation during the currency of a loan. He decides that this was not the intention of the Act; but we cannot see anything in the wording of the section to prevent it, though it is a contingency that would naturally not be realized excepting in extraordinary circumstances.

It is pointed out that the Act of 1897 was passed in the interest of the business of the Public Works Loan Commissioners, which has suffered materially of late years by the discovery on the part of the better sort of local authorities that money could be obtained in the open market upon easier terms than those offered by the Commissioners. It is doubted by the author whether the enactment will have this effect, unless the Commissioners amend their methods and terms in the sense of bringing them into harmony with the system pursued in the open market. We venture to think, however, that the suggestion that the Commissioners should compete with the open market for the loan business of local authorities is hardly in accordance with the principles guiding Treasury finance. As regards the form of Corporation securities, this was usually, prior to 1875, that of a mortgage deed. The issue of Corporation stock was first legalized in 1880, and has proved to be a very popular form of security. This form differs from the older debenture stock in that it is charged indifferently upon all the resources of the local authority issuing it; whereas a debenture stock was charged upon some particular rate or property specified. At the outset, the character of a Corporation stock was not always known to the investor. "It might be absolutely redeemable at unforeseen moments, or it might be subject to some other disability" which the investor might not be able to ascertain easily. Consequently, Sir Henry recommended twelve years ago that uniform conditions should be observed in regard to this class of stock issues, in order that investors should know exactly what their position was. At that time, the Derby Corporation Act, which had been settled after full discussion with and consideration by the Local Government Board, was the Model Act. There is no finality about these matters, however; and it was not long before the conditions of local government loan operations were improved. Some of the difficulties of trustees were relieved by the Trust Investments Acts, 1889 and 1893, which placed local securities on an almost equal footing as a trust investment with Government securities. "They gave greater confidence to the public in the stocks of Corporations; they have materially raised their market value, causing a flow of trust money into the Corporation coffers, owing to the difficulty of investing it elsewhere; and they have had the effect of reducing the rate of interest which can be demanded for loans for terms of years, with a corresponding benefit to the ratepayer." Proof is given of the last statement.

The author goes on to observe that the current belief in the stability of British Municipal Corporations is likely to be much strengthened by recent legislation relating to the issue and redemption of Corporation stock. A summary of these regulations is given. The author then calls attention to the unique facility enjoyed by the London County Council for raising money by the issue of bills at short date. By the Finance Act, 1897, these bills are to be treated as promissory notes, and not as marketable securities. It is hinted that other local authorities having important financial operations to carry on may be disposed to emulate this privilege of the London County Council. As a matter of fact, the same advantage, or almost the same, is enjoyed by many local authorities who are empowered to obtain short loans from bankers. But to authorize British Local Authorities of the first magnitude to issue twelve months' bills would be to open a new chapter of municipal advance which is not to be entered upon without due deliberation.

It is rather to be regretted that the author has not gone into the question of the differentiation of local indebtedness as between active and realizable and dead investments. He remarks that "the average man, who cares at all for the principles which ought to govern a local authority in regard to local indebtedness, has an uneasy feeling that the increase of the local debt of the country has been far too steady and rapid." But this observation comes at the end of the chapter, instead of serving, as it might have done, as the text for a disquisition upon the purposes for which loans might be legitimately required by any community, and an investigation into the means by which the capital advanced should or should not be repaid. All that we find upon this head is the following passage: "The quickened sense of the importance of citizenship, to which allusion has already been made [Progressivism?] has necessarily had a tendency to increase local indebtedness, by inducing the ratepayers to sanction loan expenditure upon buildings and permanent works which they have rightly deemed necessary to meet the requirements of an increasing population and an expanding commerce. In dealing with this subject ten years ago, we pointed out that the impetus given to the provision of sanitary works by the passing of the Public Health Acts in 1872 and 1875 involved expenditure, in many cases, which a past generation should have borne; and for this reason it was to be hoped that the time would arrive when the periodical repayment of principal on past loans would preponderate over the new debt created." This is a reasonable view to take, inasmuch as most British towns will be handed over to the next generation in a better state as regards sanitation than characterized them when the present generation came into their inheritance. But the time for the reduction of indebtedness is not yet, seeing that the amount of local loans is greater than ever it was. The positive fact, however, that the increase of local indebtedness during the last decade was proportionately very much less, having regard to the growth of population and trade, than it was for the preceding decade, is hailed by Sir Henry as "an indication that matters are tending in the right direction."

The truth is that our most progressive Municipalities cannot possibly persist for another twenty years in the way of borrowing and spending money as they have done in the past. They have had a heavy set of arrears to make up, and they have been naturally desirous of carrying over to posterity some of the burden which came to them from ancestors ignorant of sanitary science. Yet the strain upon the present and last generations has been great. Let us see how it has affected the city of Glasgow, which was one of the most neglected, and is now one of the most highly municipalized, of British cities. With a population in 1891 of 669,059, occupying an area of some 12,311 acres, which gives a density of population of 54½ persons per acre, the rateable value of the town was, in 1896-97, £4,432,576. The approximate limit of borrowing powers was £12,491,700; and the amount of the outstanding loan debt was £8,748,652, which works out to £13 per head of the population. A total amount of £13,603,630 had been expended on the equipment of the town, of which £7,399,980 had been spent upon remunerative works, comprising water, gas, tramways, electric lighting, and markets; and £6,203,650 had gone in unremunerative works. Posterity still has something to answer for here. Almost at the other extremity of the scale stands the ancient city of Canterbury, with its scanty population of 5⅝ persons to the acre, and its outstanding debt of £1½ per head. Curiously enough, the rates payable by the inhabitants of the two cities are nearly equal in amount. It might be deduced from the author's tables that some towns have proved much more costly to bring up to date than others. Huddersfield, for instance, is rated at 5s. 2d. in the pound, and has for the present a debt of £23⅜ per head. But the remunerative capital expenditure of Huddersfield has been nearly threefold the unremunerative, while there has not been time to pay off much of the outlay. If the trade

of the district holds good, Huddersfield will be well off by-and-bye. A wholly different place is Eastbourne. Here the outlay upon what are technically unremunerative works has been more than a hundredfold that on "remunerative" objects; yet the former have paid and will continue to pay well in their way.

Other of Sir Henry Burdett's tables display the loan capital expenditure of Corporations upon their various remunerative works; the revenues; and the estimated capital and income value of corporate property; also the particulars of the unremunerative expenditure. All these matters will come under review whenever a fresh movement is made in municipal finance—as, for example, in regard to the proposal for enabling the Government to invest in Corporation stocks as an alternative to Consols, with a view to preventing the undue appreciation of the latter security.

OBITUARY.

We regret to record the death, last Friday morning, of Mr. GEORGE JOSLIN, of Colchester, in his 77th year. Mr. Joslin was formerly Lessee of the Colchester Gas-Works, and was a Director of the Company until his death.

The death is announced of Sir VIVIAN MAJENDIE, K.C.B., Her Majesty's Chief Inspector of Explosives, which occurred rather suddenly at Oxford last Sunday in his 63rd year. His appointment in 1870 as Chief Inspector of Explosives brought him into greater prominence; and in this capacity he came before our readers in connection with his report on the dynamite outrage at the Tradeston Gas-Works, Glasgow, on Jan. 20, 1883.

Ex-Bailie HUGH CRAWFORD, of Partick, died suddenly while attending a meeting of the Partick Police Commission, of which he was a member, on Monday last week. Deceased was for many years cashier to the Partick, Hillhead, and Maryhill Gas Company, but relinquished the position after the undertaking was acquired by the Corporation of Glasgow in 1891-2. He had been on the Partick Police Commission for ten years, and was a Magistrate from 1891 to 1895.

PERSONAL.

Mr. J. FRED. WICKS, Engineer and Secretary of the High Wycombe Water Company, Limited, has been appointed Manager and Secretary of the High Wycombe Gaslight and Coke Company, Limited, and will in future hold the two appointments.

We have been asked to state that the Mr. Tatham mentioned in the article on "Atmospheric Gas" in the "JOURNAL" for the 12th inst. is in no way connected with Mr. EDWIN TATHAM, the inventor and patentee of the oxy-oil gas process to which the attention of gas engineers was directed a few years ago.

Mr. A. HALLIWELL, Assistant-Manager at the Brighouse Corporation Gas-Works, has been appointed Gas Manager and Secretary to the Marsden District Council, in succession to Mr. F. Lee, who goes to Hinckley. There were 86 applicants for the position. The successful candidate has been eleven years at Brighouse.

Mr. J. H. BROWN, F.C.S., Assistant to Mr. C. Armitage at the Lancaster Corporation Gas-Works, has been selected to fill the position of Assistant-Manager of the Ilford Gas-Works—an appointment for which applications were invited in the "JOURNAL" for the 8th ult. Mr. Brown is a prize medallist and the holder of a certificate in the Honours Grade in "Gas Manufacture" at the City and Guilds of London Institute, and a student of the Institution of Civil Engineers.

The officials and employees of the Gas Department of the Selby Urban District Council met last Friday for the purpose of presenting their late Engineer and Manager, Mr. MATT. DUNN, with a handsome oak *secrétaire*, as a mark of their esteem and regard. The presentation was made by the foreman of the works, Mr. Leggott, who was supported by the newly-appointed Manager, Mr. W. J. Mott, who testified to the fact that Mr. Dunn had handed over to him works in excellent order, the results produced by which were highly satisfactory—a fact brought about by the persistent effort on his part to maintain efficiency during his four years' service at Selby.

At the Thornton Road Gas-Works of the Bradford Corporation last Friday, Mr. Hayhurst presented to Mr. E. J. SUTCLIFFE, the Superintendent of the works, on behalf of the employees, a handsome English art brass clock and ornaments. Mr. Sutcliffe was a candidate for the position of Sub-Engineer in succession to Mr. Charles Wood; and when it was found that he had been unsuccessful, the workpeople decided to indicate in a tangible way their esteem for him. The workmen both at the Thornton Road and the Birkshall works subscribed to the testimonial. Mr. Hayhurst, in making the presentation, said he was very pleased to find that the relations between Mr. Sutcliffe and the workmen were of so agreeable a character; and he expressed the hope that they would always be so. Mr. Sutcliffe, in accepting the gifts, asked the employees to give the same loyal obedience to Mr. Duxbury, the new Sub-Engineer, that they would have given to himself if he had been appointed. He trusted pleasant relations would always exist between himself and the workpeople.

TECHNICAL RECORD.

EASTERN COUNTIES GAS MANAGERS' ASSOCIATION.

The Spring Meeting of the Association was held last Wednesday at Peterborough; and there was a fairly large gathering—several gentlemen having been specially invited to be present in view of the proposed discussion on the standardizing of meter-unions. During the morning some of the members visited the gas-works, for the purpose of inspecting a temporary installation of the Somzée-Greyson gas-light, for which arrangements had been made by Mr. Albert Ranson, the Secretary *pro tem.* of the Syndicate who have taken in hand the introduction of the light in Suffolk and North Essex. The conditions, however, under which the installation had been made were not favourable to a perfect display of the capabilities of the light. Subsequently light luncheon was provided at the Grand Hotel; and at two o'clock, the members assembled at the Guildhall for the transaction of formal business and the discussion of two subjects of especial interest at the present time.

On the PRESIDENT (Mr. J. T. Jolliffe, of Ipswich) taking the chair,

The HON. SECRETARY (Mr. J. H. Troughton) read the minutes of the meeting held at Ipswich in September last; and they were confirmed.

REPORT AND ACCOUNTS.

The Committee's report and the accounts for 1897 were then submitted. The former chiefly consisted of a review of the work of a very successful year under the presidency of Mr. Jolliffe; and it also showed that, both in regard to membership and financially, the Association is gaining strength. At the commencement of the year, the number of members was 64, and 6 new ones were elected; making the total membership 70. The Committee regretted that the Association had lost one member by death—viz., Mr. W. J. Wells, of Stamford, who had served on the Committee, and was one of the original members of the Association. Five members had resigned; and six had severed their connection with the Association under Rule 17. These losses reduced the membership to 58, to which 11 new names were added at this meeting. The accounts for the year showed that a balance was brought forward of £23 12s. 3d.; subscriptions received during the year amounted to £36 15s.—making a total of £60 7s. 3d. The expenditure totalled to £21 12s. 10d.; leaving a balance in hand of £38 14s. 5d., with a few subscriptions outstanding.

The PRESIDENT suggested that the report and accounts should be taken as read. He thought the members would agree with him that the report was eminently satisfactory. The balance in the hands of the Treasurer was larger than usual; indeed the Association showed signs of progress all round.

The suggestion was adopted.

NEW MEMBERS.

On the proposition of the HON. SECRETARY, seconded by Mr. J. G. HAWKINS (Spalding), the following gentlemen were elected members: Mr. John Young, of Norwich; Mr. F. R. Hunter, of Clacton-on-Sea; Mr. Alex. Mitchell, of Bury St. Edmunds; Mr. G. R. Casterton, of Biggleswade; Mr. T. Burtonshaw, of Felixstowe; Mr. J. A. Young, of Louth; Mr. J. Beck, of Stamford; Mr. G. H. Chapman, of Stamford; Mr. H. G. Edwards, of Gorleston, Great Yarmouth; Mr. R. Dawbarn, of Wisbech; and Mr. W. Beale, of Royston.

STREET LIGHTING BY INCANDESCENT GAS-BURNERS.

The PRESIDENT said, in regard to the next item on the *agenda*, he was sorry to have to make an apology. Mr. Sayer, the Gas Inspector of Ipswich, promised that he would read a paper reviewing the subject of street lighting; but at the last moment he informed their Secretary that he would be unable to do so on this occasion. He (the President) confessed this rather staggered him at first; for they trusted to the paper to occupy most of the time that afternoon. The review would undoubtedly have been most interesting; for Mr. Sayer had taken an active part in improving street lighting. Under the circumstances, he (the President) had put together a few fragmentary remarks on the subject; and these, he hoped, would be the means of raising a discussion. He would, however, ask the members not to be too critical, as he had himself been much preoccupied.

The HON. SECRETARY, at the request of the President, read the paper, as follows:—

Satisfactory street lighting should at least allow you when walking in the streets to readily recognize the features of any passer-by. Anything less is not satisfactory; and in very populous and busy centres, more is required. Mr. Sugg, in a paper which he read before The Gas Institute in 1879, laid down a reasonable and fairly practicable standard for street lighting. Some of you may probably remember the clever cartoon which accompanied the paper, in which a gentleman was portrayed, full clothed and with the regulation top hat, walking along the highway, carrying at the end of a stick a lighted lantern. Mr. Sugg, in his paper, says: "The standard is a man lighting his way with a lantern. The light is fixed to a stick in the manner most approved by our ancestors. It is, in fact, so used in the

country at the present time. The height of the lantern from the ground is just 2 feet to the centre of the flame. If the lantern is provided with a parliamentary spermaceti candle, it will, in the position I have stated, light a circle 4 feet in diameter. The amount of light anywhere on the edge of this circle will be sufficient to enable a man with good eyes to read a leading article in 'The Times' newspaper lying on the ground. This light will just enable a man to see his way before him as he walks. In a well-lighted neighbourhood where the local authorities allow each lamp 5 feet of gas per hour, and there are no shops, it will be found that this is the average kind of light which is found at 7 ft. 6 in. from the lamp-post—the lamp being 10 feet from the ground." He also, in the same paper, gave a diagram showing that, with a 10-candle burner fixed on a post 8 feet high, this light is given on the ground at nearly 10 feet from the post. With a 20-candle burner, this light is found 15 ft. 9 in. from the post; with a 50-candle burner, 26 ft. from the post; with an 80-candle burner, 33 ft. 6 in. from the post; with an 115-candle burner, 39 ft. 6 in. from the post; and with a 200-candle burner, 45 feet from the post.

Here then is a standard worked out to lights of varying intensity, and from which we can at once calculate how near to this standard of excellence is the lighting of the streets of the towns with which we are more particularly identified, and see whether it is possible for us, without materially increasing the cost to the ratepayers, to approach this standard.

To illustrate what may be done, I will state my own experience at Ipswich. In Ipswich, the maximum distance apart of the lamps is 80 yards. In the centre of the town, the distance is not so great; and I am glad to say that, on the advice of Mr. Sayer, this distance is gradually becoming lessened. Prior to 1870, the consumption of gas in each street-lamp was at the rate of 5 cubic feet per hour. In that year (probably from motives of economy—evidently very mistaken motives), the rate of consumption was reduced to 3½ cubic feet per hour; and you will readily understand what a miserable exhibition the street lighting became. Instead of being able to recognize people at any spot between the lamps, it was impossible to recognize your most intimate acquaintance at the base of the lamp-post; and, as a safeguard, the lights were absolutely useless. This system remained in force until 1887, when the consumption of gas in a number of the lamps in the centre of the town was increased to 5 cubic feet per hour; and gradually the number was extended.

After some long and exhaustive trials with incandescent burners in the public lamps, I suggested to my Directors that we might, with advantage, undertake to light the whole of the streets in the borough with these burners; and knowing how desirous our Lighting Inspector was to improve the street lighting of the borough, I intimated to him that we were not indisposed to co-operate with him in any scheme he might formulate for the consideration of his Committee. The outcome of this was the subjoined report, which Mr. Sayer laid before his Committee, and which was accepted.

Report made by Mr. E. C. Sayer, *Gas Inspector for the Borough of Ipswich, to the Electric Lighting Committee on the Cost of Adopting the Incandescent System of Gas Lighting for some of the present Public Street-Lamps.*

The incandescent gas-burner may be said to consist simply of two essential parts: First, a carefully adjusted burner of the bunsen type, in which air is mixed with the gas before it burns, generally in the proportion of 30 of gas to 70 of air, producing a substantially colourless or slightly blue flame. Second, a mantle composed of certain rare earths—zirconium, lanthanum, thorium, and cerium.

The incandescence is due to the heating of a network of oxides of the above rare earths, which emit, at the temperature of the bunsen flame, a bright, steady, and powerful white light:—

Relative Illuminating Power of Various Burners compared with the Welsbach Burner and Oil.

Burner.	Pressure in Tenths.	Gas Consumption Cubic Feet per Hour.	Candle Power per "Methven" Standard.
Bray's batswing, No. 4	10	5·00	4·8
Bray's batswing, No. 5	10	6·00	9·6
Ordinary street governor	10	5·00	14·0
Ordinary argand burner	10	5·00	15·8
Welsbach burner, with glass chimney	10	3·75	68·4
Welsbach burner, with mica chimney	10	3·50	60·0
Welsbach burner, after three months in use	10	3·75	40·0
"Belge" oil-lamp	Consumption 2 oz. per hour.		16·0

The light of the Welsbach burner is intensely white and brilliant; being equal, for only 3½ cubic feet of gas consumed, to a maximum of from 50 to 60 candles, and a certain average of 40 candles.

The photometric measurement of a mantle that had been three months in constant use is interesting, as showing how satisfactorily the illuminating power is maintained, while its illuminating power (expressed in candles) is more than three times as great as the best ordinary gas-burners or the incandescent electric lamp—each of which does not generally exceed 16-candle power, unless a very great expense is no object to the consumer. I am far from saying that the incandescent system of gas lighting has now been brought to the highest pitch of perfection. Still I am bound to regard it as the system of gas lighting which utilizes most efficiently and most economically the full powers of coal gas as an illuminating agent. Some have expressed fears that the burner is a delicate instrument; but I have found, with ordinary care, that these fears need not exist. The average life of a mantle, taking risk of breakage into consideration, is between three and six months. But I have used mantles over a year; and at the end of this time their lighting efficiency was still very good.

The cost of each street-lamp burning 5 feet of gas per hour is now as follows:—

Number of hours that each public lamp is burning = 3670.			
3670 × 5 = 18,350 at 2s. 10d. per 1000 feet =	£2	12	0
Less discount at 5 per cent.		2	7½
Cost of gas	£2	9	4½
Lighting, extinguishing, and cleaning		17	0
Total cost of lamp per annum	£3	6	4½

If the incandescent system were adopted, the consumption of gas would be somewhat less, and the cost as follows:—

3670 hours × 3·75 feet per hour = 13,765 feet, for burner.			
5096 „ × 0·25 „ = 1,247 feet, for bye-pass.			
Total gas	15,036		
15,036 at 2s. 10d. per 1000 feet =	£2	2	7
Less 5 per cent. discount		2	1½
Cost of gas	£2	0	5½
Lighting, extinguishing, and cleaning		1	0
	£3	0	5½ Total cost of gas, lighting, cleaning, &c., but exclusive of renewals of mantles and chimneys.
Present total cost per lamp per annum	£3	6	4½
Cost of incandescent burner, exclusive of renewals of mantles and chimneys	3	0	5½
Balance		5	11½

Now, assuming that each burner needs six mantles, six mantle rods, and two glass bowls per annum, we have £3 0s. 5½d. + 7s. 6d. + 3s. 3d. = £3 11s. 2½d. per annum as the total cost of each incandescent lamp; being 4s. 9¾d. per annum more than the present cost.

There are 820 lamps burning 5 feet per hour. Therefore 820 × 4s. 9¾d. = £197 6s. 3d.

The introduction of incandescent burners will, however, enable the Authority to reduce the consumption of gas in 57 large lamps as follows:—

34 lamps now burning 7 feet, reduced to 5 feet per hour, 34 × 2 × 3,670 =	249,560 cubic feet		
23 lamps now burning 10 feet, reduced to 5 feet per hour, 23 × 5 × 3,670 =	422,050 „		
	672,610 cubic feet at 2s. 10d. =	£95	5 8
Less 5 per cent. discount		4	15 8
		£90	10 0

Deducting this saving of £90 10s. from the above cost of £197 6s. 3d., and adding £13 14s. 4d. for the above 57 lamps, gives £120 10s. 7d. as the probable net additional cost of adapting incandescent burners to 877 of the public lamps. I have every reason to believe the Company would fall in with the above arrangement; and our borough would lose the stigma of being the worst lighted town in the Eastern Counties.

E. C. Sayer.

A contract for three years was entered into between the Corporation and the Gas Company on the terms set forth in this report. The burners were duly installed—the result being very striking; and the satisfaction of the ratepayers immense. Whereas before the assumed standard for public lighting extended only to the edge of a circle having a diameter of 20 feet with the lamp-post as its centre, under the improved conditions, the standard was 60 feet. The Corporation obtained five times the amount of light for an increase of about 1½ per cent. in the expenditure.

For this installation it was decided to use the Incandescent Gas Company's "C" burner, fitted with bulb and metal reflector, bye-pass lever cock and chains, and anti-vibration springs specially made by them for street lighting. This form of burner was chosen because of its greater strength, and its better capability to withstand the rough usage of street lighting. No alterations were made to the lanterns beyond reducing the size of the apertures at the top, and completely closing the openings at the bottom, excepting the small holes in the glass for the chains to work through. Before fixing the burners, the upright pipes were shortened to allow of a T-piece with plug being inserted just below the burner. The object of the T-piece being to provide means for clearing the service. Above the T an ordinary lamp-cock was fixed, and next to this the burner itself, fitted with a Peebles' governor regulated to pass 3·75 cubic feet of gas per hour. The total cost of the

installation was something under 15s. per lamp. Our estimate as to the cost of maintenance was six mantles, two glass bulbs, and six props per lamp per annum; and it is satisfactory to know that, after three years' experience, this estimate has not been exceeded.

Care was taken when fixing the burners to keep both the supply-pipe and the burner itself clear of the lantern, so as to prevent as far as possible, damage to the mantles from shock or vibration. The lamplighters report each morning any damaged mantles or defective lights; and men are told off at once to attend to the same. These men become very skilful in the manipulation of the mantles; and it is rarely that they meet with a mishap. It is found in practice that the difference in the gross and the net price of the mantle is sufficient to pay the cost of attention. Although the lanterns themselves require less cleaning than under the old system of lighting, it is very desirable to have both lantern and globe cleaned at least once a week, as dirt seems to interfere more with the light emitted from a Welsbach burner than from an ordinary flat-flame burner. All the burners are thoroughly cleaned and the service-pipe blown out in the autumn of each year.

In concluding these brief and necessarily fragmentary remarks, it will be seen that the incandescent burner offers an easy and economical means of enormously improving our street lighting even in its present form; and if the new burner which the Incandescent Gas Company purpose putting on the market in June next should give anything like the efficiency promised, we shall have at our command the means of giving to the public, at little or no extra cost, a light which will at once fulfil the standard condition fixed by our friend Mr. Sugg. Personally I have no doubt that the promised burner will give, at all events, some of the results promised; for my assistant, Mr. Prentice, has had constructed at our works a bunsen burner so perfect that, when consuming 5 cubic feet per hour, it gives a light with an ordinary mantle equal to 130 candles or 26 candles per cubic foot of gas burnt. If we, with comparatively little or no experience in the construction of burners, can make a burner yielding such high efficiency, what may we not expect from the Incandescent Gas Company with their skill and experience? Their new burner is to yield a light equal to 30 candles for each foot of gas burnt, so that a burner consuming 5 cubic feet of gas will give a light equal to 150 candles. Lights of this power placed 50 yards apart would brilliantly illuminate any street of ordinary width, and could be carried out where gas is about the same price as in Ipswich at a cost of about 9d. per mile per hour.

Discussion.

The PRESIDENT, in inviting discussion, said the reason he asked Mr. Sayer to read a paper on the subject of street lighting was because Mr. Best, at a previous meeting, in alluding to some of his (Mr. Jolliffe's) presidential remarks, expressed a desire, if it had been proper, to discuss some of the matters relating to incandescent street lighting. The opportunity to discuss them had now arrived; and he trusted Mr. Best would start the discussion by giving them his views.

Mr. W. J. BEST (St. Ives) said he had done a little with incandescent street lighting; but he could not report much progress. In his town, the lamp-pillars were somewhat "flimsy," or not very substantial; and the roads were made of cobbles. When a traction-engine passed over these roads, the vibration was very considerable, and it resulted in great destruction of the mantles. In addition to this, the lanterns were of octagon shape; and too much wind and draught got into them, which helped to wear out the mantles. The Corporation and the inhabitants would like to see improved lighting; but neither they nor the Gas Company felt disposed to buy new lamps and posts to meet the requirements of incandescent gas lighting. During a visit to Leicester, he noticed outside the gas offices, some substantial pillars and lamps for incandescent gas lighting, which appeared to be perfectly wind-proof, and which were ignited by means of electricity. This was one of the finest and most up-to-date arrangements he had seen for outside lighting. In his opinion, where they had not good substantial pillars and lamps with nearly air-tight lanterns, incandescent burners could not be used with success.

Mr. W. D. CHILD (Romford) thought the members would all agree that, in these latter days, lighting authorities and committees were more alive to the question of street lighting than they formerly were. But it appeared to him, from his experience, that they were hardly going on the right lines. They looked at the lighting question too much from the rate-collecting point of view; and, instead of taking upon themselves to light efficiently a given area, they were induced to light large districts by such considerations as the positions of the residences of the heavy ratepayers. In this way, they were led to spread out their ordinary street-lamps (in his own experience he had had to contend with this) to as much as 100 and 120 yards apart. The only usefulness of a lamp under such conditions was to show there was a light there, and to prevent people running against the post—it was really of no value either for walking or driving. However, the lighting of towns had been much improved of late by the adoption of incandescent burners; but, so far as he had gone, he could not nearly approach the figures given by the President. The paper spoke of six mantles per lamp per annum; but, in his experience, the number ran from twelve to fourteen. Since last Christmas, in 160 lamps, he had used 546 mantles; and even now, though he renewed them so frequently, he was hardly giving satisfaction to the Lighting Committee of the town. Directly they saw a ragged edge at the bottom of a mantle, the question was asked whether it ought not to be renewed. He thought there was something special about the busy portion of his town which conduced to the destruction of mantles. The subsoil was clay, and the roads were made of macadam. The vibration was very great—so much so, that he had seen a mantle jump off the crutch or support while the man was engaged in fixing it. Such extreme vibration as this had to be met in special places either by suspending the burners, or by other means. He had in some cases adopted a simple form of stand made of light wire, with a piece of rubber tube connecting the burner and the supply-pipe, so as to reduce the vibration of the burner as much as possible. He thought that everyone who adopted incandescent lighting should at once face the question as to whether it was not advisable to have new lanterns adapted both for the purpose of ventilation and the method of fixing. He had nothing to complain of as to his lamp-posts—they were of substantial construction, and well fitted. But they had the old cradle arrangement, in which the lantern hung loosely in the cradle; and, in a high wind, there was sufficient vibration in the lantern itself to cause it to jar against the stand-pipe, and to break the mantles. Every lantern used for incandescent lighting should be fixed, where the lantern had a frame coming down, with bolts on to a frog, so that there was no chance of the lantern jarring against the lamp-post. This was one of the greatest causes of breakage in his case. He thought, taking the first cost of an installation into consideration—not only the burner, but also the lantern itself, with the proper attachments—it would ultimately pay any gas company to make a complete installation rather than go on with old lanterns improperly ventilated and fitted. In such old lanterns he found a great cause of complaint was that the heat generated was sufficient to break the top glass, and cause a streaming down of a white condensation, which required considerable attention in cleaning the lanterns in order to get a good lighting effect.

Mr. R. G. SHADBOLT (Grantham) expressed his regret that Mr. Sayer had been prevented from contributing to their proceedings on this occasion. From the experience he had had of that gentleman, he had looked forward to something out of the ordinary in connection with street lighting that day. With regard to the President's paper, he did not look upon it as a "fragment." It might be so from the President's point of view; but, in his (Mr. Shadbolt's) opinion, if it were a fragment, it was a very good one. It was a fragment snatched from the oblivion of the past so far as Mr. Sayer's report was concerned; and if it had not been brought forward in the manner it had been that day, it would perhaps have been overlooked, or lost to them altogether. Taking the first part of the paper, it struck him how much better it would be if gas managers could have the lighting of the streets of their respective towns in their own hands from the branch to the burner, including the lamp and the pillar. He knew of several places, and one in particular, where the lamp columns and heads were provided by the Local Authority, and the gas was purchased from the Gas Company at the lowest possible rate. The consumption per lamp was 3 cubic feet per hour by a Sugg regulator burner; and the lamps were placed not less than 100 yards apart. In these enlightened days, how town councils could expect their streets to be properly lighted under such conditions, he could not conceive. The great obstacle in the way of improvement was that the lamps were not in the gas manager's hands. At Grantham, they were in a different position. They had the lighting in their own hands; and he ventured to assert that where this was the case the lighting and everybody concerned distinctly benefited from the arrangement. There was one thing in the paper that struck him as being rather peculiar. In fixing up the incandescent burners, the President said that below the tap he arranged for a T to be placed, for the purpose of clearing the service. He should like to know what was meant by "clearing the service." In his comparatively short experience of these matters, the service-pipes had not required cleaning, but the incandescent burners themselves had needed a great amount. In the first table in Mr. Sayer's report, he stated that a No. 4 Bray's batswing burner, at a pressure of 10·10ths, and a consumption of 5 cubic feet, only gave 4·8-candle power, which he (Mr. Shadbolt) presumed meant per foot per hour.*

The PRESIDENT said he could not positively say; but he should think not.

Mr. SHADBOLT observed farther down the table that a Welsbach burner, consuming 3·75 cubic feet of gas, gave an illuminating power of 68·4 candles.

The PRESIDENT said he believed the figures were total values in all cases.

Mr. SHADBOLT (proceeding) said, if this was so, then the Bray batswing burner gave less than 1 candle per foot per hour. He judged that this was the meaning of it; and, if it was so, it must have been a very bad burner indeed. The same might be said with regard to the second burner referred to. In tests

* Since the meeting we have received from Mr. Sayer a communication in which he says that the figures given for the No. 4 Bray burner were incorrect. They referred to a No. 3 burner; and those for a No. 4 should have been, at 1-inch pressure, 5·4 cubic feet consumption, and 6·2 candle power. The burners tested were in use at the Ipswich Town Hall.

of his own, he found with an ordinary burner—one of Hawkins and Barton's regulator burners—consuming 5 cubic feet of 17½-candle gas per hour, he could obtain a light of 14 candles. With respect to the cost of incandescent lighting worked out on the basis given in the paper, he did not quite agree; but he did agree that six mantles per lamp per lighting season—in his case 3000 hours—was borne out in practice. He might also say that the renewals of rods and globes were in the same proportion as was given in the latter part of the paper. When they wished to introduce incandescent gas lighting into the streets of Grantham, he put it to the Corporation in this way. The Company, he might first explain, owned the lamp columns, and all pertaining to them; and they did the lighting by contract. They had a sliding-scale according to the price of coal. If the price of coal increased by 1s. per ton, they obtained 1s. more per lamp per 2000 hours—that was for lamps burning 5 cubic feet per hour. He worked the matter out, and then put it to the Corporation in this way: "If you are public-spirited enough to increase the cost of public lighting by 16 per cent., we are prepared to increase the light over that obtained by the 5 cubic feet burners by 300 per cent.;" and the Corporation accepted this. The members had heard that at Ipswich and elsewhere six mantles would represent the renewals per lamp per annum; and that was about correct. At Grantham they had come as low as five mantles; and, so far as concerned breakages, they could have come lower still. But he must confess that they had had to renew the mantles not because they had been fractured, or because of the vibration or other outside cause, but simply because the light had become dim. It was not for them as ordinary gas managers to debate with chemists the causes of this depreciation in the incandescence—as to whether it was due to catalytic action, or whether the mantle simply tired out. Whatever the cause might be, it might interest members to know that he had two mantles in use to-day which gave as good a light as when they were put on two years ago. But, generally speaking, if they attempted to do with less than six mantles per lighting season of 3000 hours, they were compelled to renew the mantles owing to the dimness of the light. In this respect, the new Welsbach burner and the results obtained by Mr. Prentice were remarkable. He (Mr. Shadbolt) concluded that the highest duty with the incandescent gas-light was obtained when the mixture of gas and air in the bunsen burner came nearly to the explosive point. He had arrived at this opinion especially from experiments with the "Sunlight" burner. Still the results obtained by Mr. Prentice far and away exceeded anything he (Mr. Shadbolt) had been led to expect. The Welsbach Company claimed that, with their new burner, not only could they obtain 30 candles per cubic foot of gas consumed, but if they had a variation up to 9 or 10 cubic feet per hour, they could obtain an equal proportion of light. He confessed that he could not see how this was done. Mr. Best had evidently fallen upon evil times and evil circumstances; and he commiserated most sincerely with him in his position. He (Mr. Shadbolt) had not been called upon to deal with "flimsy" lamp columns, because the Company had to provide them. He could not conceive himself that the stability of the lamp column could have as much to do with the destruction of mantles as the position of the service-pipe, and its contact with the kerb or channel stones. He had taken out service-pipes that had passed under the kerb or channel stones, and which had touched at one particular point; and it required careful investigation to find out where the contact really occurred. He had had a Denayrouze lamp which had given good results where the bowl of an ordinary incandescent burner was shaken off by the vibration. They tried the Denayrouze burner because it had no bowl to topple off; and they found the mantle withstood the vibration very well. But a most remarkable thing had occurred. The vibration was of such a nature that it gradually worked out the bye-pass screw until it fell to the bottom of the lamp; and yet the mantle itself was not injured. He could not tell the cause of this vibration, unless it was this: The road was asphalted some time ago, and the surface was rather rounded. He was of opinion that the channel stone which pressed against the side of the lamp column touched the kerb, and this in turn touched the service—causing it to be in intimate contact with the coating of the road. This resulted in a certain amount of compression, which caused the shaking. Although they had a variety of lamp columns, their experience so far, with the exception of this case (which they had not so far disposed of), was that it had been the service-pipe and not the lamp column which had been the ruin of the mantles. As to anti-vibrators, he had heard it said that, as a rule, they were more mantle destroyers than mantle savers. That was also his experience. They had tried all sorts of devices, but had discarded them altogether.

Mr. Best asked to be allowed to explain that the streets in his town were cobbled; and, living in an agricultural district, the traction engine was a frequent visitor. After one had passed through, they found many of the mantles were destroyed. In macadamized streets, they would not have so much vibration as in cobbled streets.

Mr. F. Prentice (Ipswich) said the subject of incandescent lighting was one that had interested him greatly, and one in which he had made a vast number of experiments in many directions to try to find a good burner; and hence this discussion appealed to him especially. Mr. Best seemed to have had great difficulty with his efforts in this way; and he attributed it largely to the posts and to vibration. He (Mr. Prentice) was very much of the opinion of Mr. Shadbolt that the posts had nothing whatever to do with it; but that it was the service-pipes that required protection in order to prevent vibration. In Ipswich, they had a variety of means of doing away with this destruction of mantles. But while one method answered very well in one lamp, it did not necessarily follow that it would answer in another, because the destruction of the mantle might be due to a different cause altogether. Although they now used less than six mantles per lamp per annum, he was pretty well certain this number could be reduced by at least half when every lamp had been specially attended to. In cases where a large number of mantles had been broken, when the reason was found out, the lamps would go just as well as the others. They had some instances in which the mantles had been in use twelve months without breaking. In the lamps at Ipswich they used frogs; it was certainly unfair to put mantles in lamps that swung about. They had a great number of traction engines in the town. They made them there by the hundred; and they were sent out at all times for the purpose of testing them. They were driven up and down the streets, and shook the place very considerably. But this had not been found to be a serious cause of breakage of mantles, if the service-pipes were only laid in a proper manner. Regarding the depreciation of the mantles, they had not experienced it at Ipswich to anything like the extent that Mr. Shadbolt appeared to have done. There were one or two things that he had noticed which caused the mantles to become dim. One was the partial passing of unpurified gas. If there was a slight taint of sulphuretted hydrogen in the gas, in his opinion it reduced very materially the lighting value of the mantle. Another cause of dimness of the light in the summer time was this: If one looked inside a burner, he would find some thousands of tiny flies, filling up the bottom of the burner almost entirely. It was remarkable how they got in. He was of opinion that, if Mr. Shadbolt took off his mantles, and thoroughly blew out the burners, he would get something like 40 candles out of them, or almost the same light as when he started. Mr. Shadbolt was under a strange misapprehension when he said that the new Welsbach burner would give 30 candles per foot of gas for any quantity consumed from ½ foot up to 10 feet per hour. The misunderstanding was consequent upon a statement made by the Chairman of the Welsbach Company; and perhaps Mr. Sheldrake (who was present) would be able to give them some information on the subject. The Welsbach Company he (Mr. Prentice) understood made a variety of burners which would give 30 candles per foot for the quantity of gas the burner was made to consume. This did not seem so unreasonable as the other statement.

Mr. Shadbolt: I fail to see how it can be reduced *pro ratâ* to any particular consumption for one burner.

Mr. Prentice said he had not had an opportunity of experimenting with, nor did he know anything about, the new Welsbach burner; but he had no doubt that the result he had mentioned could be obtained. He had come very near it himself; and it was not a difficult thing. If they studied the flame itself, and simply endeavoured to produce a flame of such a size that the mantle could be suspended in the hottest part of it, they could get 26 candles per foot of gas consumed. He had obtained 26·9 candles; and, after a little more experimenting, he thought he would get a result as high as was claimed for the new Welsbach burner. The Somzée-Greyson burner gave 30 candles per cubic foot of gas consumed. He had tested it most carefully in a photometer; but at first he was not particularly favourably impressed with it, because of the necessity of having to get the high pressure of 7½ inches for it.

Mr. Shadbolt wished to add, with regard to the cleaning of the burners, that every time they renewed a mantle the burners were taken to pieces, and cleaned thoroughly.

Mr. A. Drage (East Dereham) said that, some two or three years since, thirty incandescent lamps were fitted up in his town. With regard to the mantle renewals, during the first year the lamps were lighted, 8 dozen mantles were purchased. They did not light for the whole of the year; and, if they did, the renewals would not average more than three per annum. During the year they only had two bowls broken, and 72 rods, which gave a lower average than was allowed in Mr. Sayer's report. Of course, East Dereham was only a small town; but to his own knowledge there were thirteen traction engines in the neighbourhood, and these were running backwards and forwards through the streets all day long. He had never had any mantles broken by vibration. He thought the fault of mantles being fractured in this way was that the service-pipes were laid too fleet in the ground. He placed his service-pipes as deep as possible; and he had no trouble whatever from vibration. He considered that some of the new lamps were not sufficiently heavy for the lights; his old lamps were all heavy ones. The only drawback was that he found he had too much ventilation; and he had to block up some of the top ventilation in order to maintain the lights. By using the bulb form of burner in the old heavy lanterns (which were all made of copper), the mantles were not broken. He did not renew a mantle directly he found a ragged edge; but he did so as soon as the light began to burn dim. To obtain the greatest efficiency, much depended upon the mixing of the gas and air. With some of the burners, he had found that, by placing his fingers

over one or two of the air-holes, the light was much increased. In these cases, he had taken the burners to pieces; and by rymering the holes out where the gas passed through, he had obtained the same amount of light as the other burners gave. With regard to the burner-tap, he had discarded the chain and ring system, as he found the chain often caught on the glass, and had introduced copper wire, so that there was no friction. He was now doing away with the tap belonging to the burner, and was working the bye-pass direct from the service-cock on the pipe. By doing this, he had saved several mantles.

Mr. J. H. Sheldrake (of the Welsbach Company), having been invited by the President to speak, said he had listened with considerable interest to the discussion. He thought the members would all agree with him that the great points in incandescent street lighting were to have the service-pipes properly insulated away from the lamp columns, and to have properly constructed lanterns. He had frequently found where there was a great breakage of mantles, that the lanterns were either open at the top or bottom to such an extent that the lights were subjected to winds and inclement weather; and under such conditions, the mantles, of course, did not stand a fair chance. In the course of his experience, he had come across numerous instances round about London where there was great waste of mantles through vibration produced by the traffic. On investigating the cause of this, he had in most cases found that the service-pipes were so wedged into the columns that every vibration on the road was conveyed direct to the mantles; but by releasing the wedges, the breakage of mantles had been arrested. As to the new burner which was shortly to be introduced by the Welsbach Company, the previous night he had tested one from which he obtained 114 candles light for only 4·2 cubic feet of gas. It was a burner without a chimney. The burner had not yet left the laboratory; but there would be an exhibition in London at the beginning of May, at which a photometer would be provided, so that any gentleman who cared to do so could test its efficiency for himself. He believed the new burner would be a great success, especially for street lighting. It would also be adapted for domestic use; but for street lighting he was convinced it had before it a very large future. Some eight or nine years ago, he had the honour of speaking to the Prince of Wales at Sandringham; and His Royal Highness then expressed the opinion that the lighting of the streets of London was a disgrace to the country, compared with the lighting on the Continent. In Berlin, the lighting of the streets was splendidly carried out; and there the lamps were each fitted with at least two Welsbach mantles. He believed that a burner consuming 4 cubic feet per hour, and giving an illuminating power of 100 candles, would be generally adopted. That was what was wanted.

Mr. R. J. Sharman (Wisbech) said that last year his Company had occasion to enter into a fresh contract with the Corporation for street lighting; and the latter expressed a wish that the Company should put up a number of incandescent lights. He could not give any figures yet, as he had not made up the accounts. It was, however, probable that they would lose on the incandescent lighting the first year; but it would fall upon him (Mr. Sharman) to see that they did not do so in future. At the expiration of twelve months, it was likely that the Corporation would ask them to increase the number of lights; as it was stipulated in the contract that the Company should put up a certain number each year. In his small town, they had nearly 350 street-lamps, with a population of about 12,000; so that it would be seen they were not backward in the matter of street lighting. Previous to the introduction of incandescent burners in the town, he fixed one of the lights close to the river side and near a small wooden bridge, where there was no end of vibration. The results were most satisfactory. They did not use more than three mantles a year—that was lighting 2600 hours; the lamps being turned out two months in the summer time. With regard to general incandescent lighting, however, they had not come down to six mantles per lamp per annum, or anything like it. But when they got things into a better state, and could give more time to the lamps, he hoped to come down to six; and he was inclined to think the number would go even lower than that. In conclusion, he expressed a preference for the suspension form of lamp.

Mr. Child wished to supplement his previous remarks as to the use of anti-vibrators. He had a number of incandescent lamps fixed in the Market Place, which was paved with granite cubes. He exercised the utmost care in fitting these burners and lanterns; but, notwithstanding, they had breakages every three or four days. He found a simple remedy for this. Instead of fixing the burner direct on to the top of the stand-pipe, he made a support of four wire legs, riveted to a centre plate of sufficient strength to carry the burner, which he connected to the stand-pipe by a piece of good black rubber tube. Whereas formerly the life of the mantles was only two or three days, by this simple arrangement they now lasted four or five months. He did not think the number of hours the lamps were burning had the slightest effect upon the life of the mantles—they were just as likely to be injured when not in use as when alight; nor did he think that the quality of the gas had anything to do with the length of their life.

The President, in closing the discussion, said he thought it should be the policy of every gas company to further in every possible manner the lighting of the public streets, and even to go out of their way to do this. It was only by hearty co-operation with the public and lighting authorities that gas companies could hope to hold their own against the more modern competitor. Mr. Best had been very unfortunate in the results of his trials with incandescent lamps; but he should strongly advise him not to give up. Whether his streets were cobbled or not, if he tried, he (the President) was sure he would succeed. He did not believe in the word "failure" at all. Each burner and lamp-post, as Mr. Prentice indicated, wanted separate treatment. That they could be brought into line, he felt perfectly confident. Nearly all the discussion had turned upon the life of the mantle. He told them in the few remarks he had jotted down that his first estimate for renewals had not been exceeded. He could, if he chose, tell them even a prettier tale than that; but it did not suit his purpose to do so. Though the general result had been so satisfactory, they had had lamps in which they had gone to as high as 19 and 20 mantles per annum for renewals. But they found out the cause, and remedied it; and so brought these "troublesome fellows" into line with their comrades. He thought with Mr. Shadbolt that it was better that the lamps and columns should belong to the Gas Company, as they certainly had then a greater control over them, and could attend to them better than if they were in the hands of the lighting authority. Personally, he was not troubled in this respect, as Mr. Sayer combined with the Company to make the lighting as successful as possible. As to the tests of burners given in Mr. Sayer's report, the Bray burners experimented with must have been unfortunate ones, because it was well known that, with 15 or 16 candle gas, they could get a lighting efficiency of 2·3, 2·4, and even 2·5 candles per cubic foot of gas consumed. Beyond this, he agreed with the tests. The sliding-scale Mr. Shadbolt had brought before them was interesting; and it was one they might well copy. If Mr. Shadbolt could give 300 per cent. increase of light for 16 per cent. increase in the gas account for street lighting, the public were bound to gain by it. As to the duration of the life of the mantles, he did not think it wise to allow them to continue in use too long. There was a serious diminution in the lighting efficiency of the mantles after a long life; and if the lighting was to be satisfactory—and that was their aim—he thought it was wise to renew them a little more often. He did not think he should try to make the average life more than three months, or four mantles per annum. Cleaning the burners was a very important matter. Every autumn they took the burners down at Ipswich, and cleaned them thoroughly before starting the winter. They had at other times to take burners down to clean them; and when this was done, it would be found that the mantles gave almost their former light. In his opinion, Mr. Drage was entirely wrong when he attempted to interfere with the air passages of the bunsen burners supplied by the Welsbach Company. To contract or enlarge the air-holes was a mistake; and, in his judgment, the cause of the diminution of the light must be due to some purely local circumstance. *A propos* of this public lighting question was the Somzée-Greyson light. It was his good fortune to be able to inspect this in London some time back. He was so much struck with it—not probably with the economical results, but with the actual results—that he agreed to undertake some experiments. He found that the efficiency with the ordinary Welsbach mantle was very high—being over 30 candles per cubic foot of gas consumed. But there was one fatal drawback to it, and that was the need of a motor to give increased pressure. The Syndicate sent it out with a water-motor, in order to increase the pressure to 7½ inches; and the burner was so proportioned in its gas area that at this velocity, it drew in sufficient air to bring the mixture as nearly as possible to the explosive point which Mr. Shadbolt mentioned. There was no doubt that to this was due the high efficiency of the burner. He could only regard it as a light that was applicable to certain cases where motive power was handy already—such as for lighting workshops, and so on. The Somzée-Greyson people claimed that they had strengthened the mantle, and that they had attained this great end by treating the mantle by some secret solution. After being so treated, the mantle could be handled, which was not the case with the ordinary Welsbach mantle. He was very pleased indeed with the discussion, which had been most interesting.

The Standardizing of Meter-Unions.

The next subject discussed was that of the standardizing of meter-unions. Messrs. W. Parkinson and Co. had sent for the inspection of the members a copy of the set of gauges which was approved by the Board of Trade a few years ago; and there was also a sample of meter-unions from the Gas-Meter Company.

The President, in opening the discussion, stated that a few years ago the North British Association initiated a discussion on the question of the standardizing of meter-unions; and they asked that the matter might be brought before the members of this Association. The standardizing of meter unions was so important and advisable that no words of his were needed to introduce the subject.

The Hon. Secretary announced that he had received a number of letters on the question, among which was one from Messrs. Guest and Chrimes, who stated that, if the standardizing of meter-unions was generally agreed to by the meter makers, they would be glad to comply.

Mr. H. WIMHURST (Sleaford) thought it was desirable that a standard set of meter-unions should be adopted; and he suggested to the meter makers that they should adopt the standard Whitworth gas thread for all sizes, so that gas managers could, with their ordinary stocks and dies and tubes effect any little repairs necessary. His own opinion was this (leaving 2-light meters out of the question) that the meter-unions should be made in pairs of the same standard sizes—that was to say, 3 light and 5 light meters, 10 and 20 light, 30 and 50 light, and 80 and 100 light. They were often called upon to replace a 3-light meter by a 5-light one, a 10-light by a 20-light, and so on; and the unions should be interchangeable. The model gauges before them were certainly very nice; but to his mind they did not fulfil what was required, as they were not gas-thread sizes. As far as possible also, the meters from different makers should be the same in height, which would obviate the necessity of altering the height of the service-pipes, in the event of a change being made from one maker to another.

Mr. SHADBOLT inquired what the North British Association suggested.

The HON. SECRETARY replied that they suggested that each Association should nominate a small deputation to attend a conference in London for the purpose of discussing the matter.

Mr. SHADBOLT said it seemed to him it would be futile for them to discuss or suggest at that meeting what they thought would be best; and all that remained for them to do was to select their representatives. He thought it was a desirable object; and with the President's permission, he would move that a deputation be appointed to take part in the conference.

Mr. BEST considered that, if meter-unions were made uniform for all meters up to 10-light, it would be a great benefit to gas managers generally.

Mr. CHILD agreed with Mr. Shadbolt that it would be of little use discussing the details of the matter, and that the best step for them to take would be to appoint a deputation.

The PRESIDENT mentioned that there were several gentlemen present representing the meter makers; and he invited them to briefly address the meeting.

Mr. J. L. CLOUDESLEY (Messrs. W. & B. Cowan) said that he thought the suggestion that had been made by Mr. Shadbolt and Mr. Child was very sensible, and to the point. It would be very difficult to discuss details there; and it would serve no good purpose. The meter makers had for many years been trying to arrive at some uniform standard; and, generally speaking, he thought they were more alive now in regard to this matter than ever they were. The Board of Trade in 1887 issued a report, which appeared in the official records, recommending the dies that were now before the meeting; but the matter was never seriously taken up. However, he believed the Weights and Measures Department were very anxious to co-operate with the gas companies and the trade generally to arrive at a particular standard. He felt sure there would be no difficulty from their side; and it only needed, as had been said, co-operation on the part of gas companies and the trade to arrive at a solution of the difficulty.

Mr. D. MACFIE (Messrs. James Milne and Son) said he felt it somewhat of an intrusion to take part in the deliberations of the Association; but since he had been asked to offer a few remarks on the subject before them, he might explain that his only title to do so was that he had been familiar with the steps already taken by the North British Association in connection with the standardizing of meter-unions. This was no new question; for there had been several attempts, more or less futile, in this direction. There had been some approach to similarity in the screw threads sent out by various makers; but, of course, anything that fell short of interchangeableness in screwed unions of meters of similar capacity did not meet the requirements of the case. Theoretically, there could be no two opinions as to the desirability of having an interchangeable standard series of screw threads; and he did not suppose that any meter maker or gas manager would take the opposite view. If, however, there was to be any approach to the desired uniformity, the proposal must emanate from the purchasers, rather than from the manufacturers, of meters; and accordingly he thought that the subject was one for consideration by District Associations in the first instance. When the result of the discussions was tabulated, some effective step might be taken to give effect to the concensus of opinion. Meter makers could hardly take the initiative; for it was only natural that each maker should think his own range of screw threads to be correct; and it was hardly likely that any maker would give up his cherished belief by the acceptance of another maker's series as the standard screw thread to be adopted. All the same, it was possible even now for one maker to supply meters with unions to another maker's standard, if orders were so specified; and there was at least one large gas company who insisted on having unions made to their own gauges. The inference was that, if meter unions were to be standardized, this should be gone about without any reference to the screws now in use, and that a new range of screw threads should be instituted. It should, however, be borne in mind that the ultimate adoption of such a standard would not prove of any immediate advantage, but would be in the nature of legislation for posterity, to which there could be no possible objection, provided that the reform commended itself to the profession generally. The present agitation for standardizing of meter-union was initiated by Mr. Myers, of Saltcoats, in a paper read before the North British Association at Melrose in July, 1895; and, so far as that Association were concerned, the views expressed by Mr. Myers were generally approved. But differences of opinion were expressed as to how effect might be given to those views; and in the light of what had since transpired, it might be suggested that, instead of committing themselves to the series of iron pipe threads specified by Mr. Myers, it would have been sufficient had the North British Association limited their recommendation to the adoption of a standard—leaving the details to be worked out after full and free exchange of views throughout the whole country. This was the position of affairs at the present time. It appeared to him that, if the District Associations should resolve that the standardizing of meter-unions was a desirable thing, and if their resolutions should ultimately be confirmed by The Gas Institute and the Institution of Gas Engineers, the matter would be within sight of easy settlement; and the result would be the adoption of a standard which would be acceptable throughout the whole country. At that stage, the assistance of the Standards Department of the Board of Trade might be requisitioned, with the view of giving effect to the united views of the gas industry. It was no doubt within the knowledge of the members that a set of gauges of iron pipe thread sizes as suggested in Mr. Myers's paper was prepared at the instance of the North British Association, and that it was afterwards discovered that a set of gauges had some years before been deposited with the Standards Department. There were therefore two sets of gauges already in existence; so that they were not limited to "Hobson's choice." He had no doubt that the purpose of the North British Association in agitating for the standardizing of meter-unions would be equally served no matter which set was adopted; or even if, after consultation with the parties interested, it should be thought better to throw both sets aside, and prepare a new and independent set of standards—the settlement would be equally satisfactory as a contribution to the standardizing of screw threads, which in all departments of industry was a consummation devoutly to be wished.

Mr. T. WILKINS (Gas-Meter Company) said that his chief, Mr. R. L. Andrews, had deputed him (Mr. Wilkins) to attend the meeting, and to say that he was in perfect sympathy with the Association in this matter. Some years ago, when Mr. Charles Gandon was President of The Gas Institute, the subject was discussed, but was allowed to fall into abeyance. The Gas-Meter Company at the time furnished Mr. Gandon with a set of meter connections to a standard gauge; and some time afterwards, they supplied Mr. Chaney, of the Standards Department, at his own request, with a similar set. It might be in the recollection of some of the members that a few years since, when Mr. T. W. R. White, of Sherborne, was President of the South-West Association, the subject was again discussed; but nothing emanated from it. If the question was to be brought to a successful issue, it must be taken up with determination, and the whole of the profession agree to it. The Gas-Meter Company would then be only too pleased to fall into line with gas managers.

Mr. W. E. TOYNTON (Messrs. W. Parkinson and Co.) explained that the set of gauges which the firm he represented had sent down was a duplicate of the set deposited with the Board of Trade. As Mr. Cloudesley had explained, whatever the whole of the profession decided upon, the meter makers would be prepared to adopt. It was for gas managers to say what they wanted; and the meter makers would be only too pleased to supply their demands. Of course, there would have to be a perfectly unanimous decision on the subject, as it would lead to endless confusion if the makers had to keep half a dozen different sizes of unions in stock to supply different districts. Regarding the sizes used now, he did not think there was very much difference in the gauges. In the case of the London makers, he found very little variation; their unions seemed to fit each other's fairly well. He should like to hear the experience of some of the members of the profession in the South, as he knew there was a great deal of difference between the North and the South.

Mr. WILKINS mentioned that the set of unions the Gas-Meter Company had sent down was used by one of the largest gas companies in London.

Mr. JOHN GLOVER (Messrs. Thomas Glover and Co.) said he was closely connected with the set of gauges which was made by Messrs. Parkinson and Co., and brought before Mr. Chaney in May, 1887. With Mr. Chaney at that time, after some considerable trouble, he arrived at a standard which he thought would meet the requirements not only of the meter makers, but of the gas world generally. He might say that the whole of the meter makers south, and he should think two-thirds of the meter makers at Oldham, also some of the Scotch meter makers, were agreed upon a certain standard at the present time. There were in existence between 5 and 6 million meters; and if a new standard was introduced, the meter makers would be only too pleased to fall in with it. He could not help thinking, however, that it would be a great waste of money to adopt a totally different gauge of meter-unions from that existing at the present time. If he might be allowed to do so, he would suggest to the Association, or to whatever body was deputed the task of dealing with the matter, that they should rather form themselves into a Committee of Inquiry so as to ascertain how close the various

makers agreed with each other. He thought he was not very far wrong when he told them that three-quarters of the meters now in existence were interchangeable, and that there was only a very small section that came from the north that did not interchange with the standard. Now the history of these unions was this: They arose from a standard which was created by Crosley in his original wet gas-meter. That standard, he believed, was in possession of Messrs. Parkinson and Co. at the present day. The standard for dry meters originated with Richards, who afterwards became Croll and Richards, and subsequently Croll and Glover. These standards, Messrs. Thomas Glover and Co. had in their possession. The only difference between the Crosley and the Richards standards was in the 3-light meter; and the variation was that one had 12½ threads to the inch and the other 13. This was a very minute difference. There was certainly a variation in the nose of the lining; and there was a slight variation in the mouth of the cap. If a Committee of Inquiry were formed, they would find that three-quarters of the present meters in existence were interchangeable. By doing this, a very large outlay would be avoided. If they took the expense of altering all their unions and the union ends of their pipes, it would represent a large amount. There was no necessity for incurring this expense when such a large proportion of the meters in use interchanged with each other; and it would be found that eventually the minority of the meter makers would have to fall into line with the others.

Mr. TOYNTON asked Mr. Glover whether he had not made a mistake as to the 12½ and 13 threads to the inch in the case of the 3-light meters. Should it not be 18 and 20?

Mr. GLOVER replied that he had made a mistake, and Mr. Toynton was right.

Mr. TOYNTON said the original Crosley standard was 18, and Richards's standard 20.

Mr. W. H. JOHNSTON (Messrs. R. Laidlaw and Son) said his firm would be glad to fall into line in any arrangement that was made in order to bring the matter to a head.

The PRESIDENT said it would be folly to discard such a large percentage of their meters as Mr. John Glover had alluded to; but it was desirable that they should, if possible, have a standard. Whether they had a Committee of Inquiry or a Conference to decide the question did not much matter, so long as some such Committee was formed.

On the motion of Mr. SHADBOLT, the President-elect (Mr. Child) and the Hon. Secretary were appointed to represent the Association at the proposed Conference.

ELECTION OF OFFICE-BEARERS.

On the proposition of the PRESIDENT, seconded by Mr. C. W. GRIMWOOD (Sudbury), Mr. Child was unanimously elected President for the ensuing year.

Mr. CHILD, in responding, said his connection with the Association had been of so comparatively short duration that he was proud the members had asked him to accept the presidency. He should do all he could to maintain the Association at the high standard to which it had been brought by former Presidents.

The CHAIRMAN, in moving that Mr. H. Wimhurst be elected to the vice-presidency, said they had somewhat sinned in having postponed this honour so long. For the amount of work Mr. Wimhurst had done for the Association, he ought to have been elected President at the time he retired from the secretaryship. It seemed to have been quite an oversight on the part of the Committee.

Mr. SHARMAN seconded the motion, which was heartily agreed to.

Mr. WIMHURST briefly thanked the members for the honour so unanimously conferred on him.

Mr. J. G. Hawkins (Spalding) and Mr. J. E. Buckle (Woodbridge) were elected members of the Committee; and Messrs. Ellis and Panchen were re-appointed as Auditors.

The PRESIDENT, in moving the re-election of Mr. Troughton as Hon. Secretary and Treasurer, spoke of the enthusiastic manner in which he entered into his work.

Mr. CHILD seconded the motion, which was cordially agreed to.

Mr. TROUGHTON suitably acknowledged the complimentary remarks made by the President, and the manner in which the members had endorsed the motion.

THE AUTUMN MEETING.

On the proposition of the PRESIDENT, seconded by Mr. JOHN BARTON (Peterborough), it was decided to hold the autumn meeting at Romford.

VOTES OF THANKS.

Mr. CHILD proposed a vote of thanks to Mr. Jolliffe for the able manner in which he had presided over the Association during the past eighteen months. The members would agree with him when he said that the best interests of the Association had been studied during this period; and their President had done much, by his conduct of the meetings and in other ways, to maintain the standard to which the Association had attained.

Mr. SHADBOLT, in seconding, said he should like to refer to the exceptional period during which Mr. Jolliffe had reigned over them. He had piloted them through a time that was unique in the history of the Association; and he had done it well, taking into consideration the various disadvantages under which he had laboured.

The motion was heartily agreed to.

The PRESIDENT, in responding, said he was extremely obliged for the kindly expression the mover and seconder had given to his efforts. If they had been at all so successful as the members seemed to think, he was more than repaid; and he should hand over with greater pleasure the roll of office to the gentleman who had been selected to succeed him.

The services of the Committee, Auditors, and Hon. Secretary and Treasurer were duly acknowledged; and a vote of thanks to the Mayor and Corporation for granting the use of the Guildhall for the meeting was also passed. To the last-named vote, Mr. D. H. REDHEAD, a member of the Corporation and a Director of the Gas Company, responded.

In the evening, the members, with numerous friends, dined at the Grand Hotel.

OHIO (U.S.A.) GASLIGHT ASSOCIATION.

The Annual Meeting at Cleveland.

(*Concluded from p.* 887.)

Mr. Irvin Butterworth, of Columbus, followed with a paper entitled "Still Another Purifying-Box," describing a new design suggested by Mr. H. L. Doherty, of Madison (Wis.), and worked out conjointly with himself. This paper, with the illustrations, is given on the opposite page of the "JOURNAL." A conversational discussion followed, in the course of which Mr. Doherty invited the fullest criticism. Most of the members, however, appeared to regard the design with favour, and no special point was made against it.

Mr. Moses Coombs, of Youngstown, read a paper on "Comparative Results with and without the Use of a Continuous Oxide Revivifier." He worked a set of four boxes in rotation; one being always idle. Each box was 10 feet by 12 feet, charged with 6 inches thickness of breeze, 18 inches of oxide, and above this a layer of lime and chips 5 inches thick. In 1897, he fixed an apparatus for injecting air at the exhauster-inlet, comprising a 10-light meter and steam-injector, by means of which he could introduce 1½ or 2 per cent. of air. In connection with this, he advocated the use of a pressure-gauge, as the degree of exhaust caused by the steam-jet was useful as indicating the quantity of air passing. During the ten months ended Feb. 25, 1897, he made 30 million cubic feet of gas, and changed 34 purifiers; representing 6274 cubic feet per bushel of oxide. But during the ten months ended Feb. 27, 1898, though he made 31 million cubic feet, there were only 10 changes; giving 28,571 cubic feet of gas purified per bushel. The only difference in working during the two years, was the introduction of the above device. He made coal gas; using Youghiogheny coal, and 10 per cent. of cannel.

Discussion being invited, Mr. Doherty said he had tried a similar process, but fancied the use of air caused a noticeable odour from the gas burnt in an open-flame stove; so he could almost tell from the fumes of a gas-heating stove in his house if the air process was in use or not at the works. The best results he obtained were not by admitting air continuously, but by shutting the gas off during the injection of air. He not only purified a larger proportion per bushel of oxide, but also found the revivification was more reliable than when air was mixed with the gas. Mr. M'Donald said he had never known an atmospheric burner that did not emit a certain sweetish disagreeable smell, when artificial gas was used; and it was remarkable that this result was not produced with natural gas. Adding air at the works would produce the same effect as air added at the stove. Mr. Thompson thought that lime was not of much use, as it became saturated very early in the charge. The smell referred to as caused by the air process might be due to the liberation of a small proportion of sulphurous acid. The gauge placed close to the air-inlet would not give an accurate reading; it should be on the meter-outlet. The chief difficulty in connection with the air process, in his experience, was that the meter would not stand the racket. Mr. Coombs, in replying, said that the air process did not decrease the illuminating power. He used an ordinary meter, but wore it out in a year. He had not tried the other way of working, but had experienced the odour mentioned by Mr. Doherty. The tray of lime and chips was introduced as a cure for this, and proved a perfect success. He was formerly troubled with back-pressure; but since using air, this difficulty had disappeared—which was remarkable, as the oxide got harder in the course of use than before. He made his own oxide, with sawdust and iron filings. The lime took out carbonic acid as far as it would reach, and counted for something. His gauge was sufficiently accurate for practical purposes.

The Question-Box was then opened. Replying to an inquiry as to the best means of locating leaks in services and mains, Mr. Jenkins recommended persistent and systematic attention to this point. In some towns there were no asphalted, paved, or even macadamized roads; and a leak could thus be easily and rapidly located. But in cities like Cleveland, with miles of asphalted or blocked-paved streets, the location of a leak was a difficult matter. He regularly inspected all service-boxes; lifting the lids, and noticing if there was a smell of gas. Mr. Schmidt said that at Sandusky he had a rocky, porous soil, in

which the only way to trace a leak was to follow the pipe. At one time he lost 25 per cent.; but by persistent hard work, he had reduced this to 12 per cent., and hoped to do better. Mr. Coombs said that leakage in percentage terms was misleading. What was the loss per mile of main? At Youngstown, he had 20 miles of mains; and the loss was about 3½ million cubic feet per annum.

A long discussion followed as to the use of cement joints for street mains. Some of the members had found a difficulty in making sound joints; and this was ascribed either to poor cement, not sufficient care in packing the joint, or jarring of the pipe by setting up the lead joints. About one joint in five is made with lead in the usual way; and this should be completed previously to making the cement joints, or else not till it had thoroughly set. Mr. Mayers had laid a mile of 24-inch pipe in this way, and made a sound job. At first several joints had to be remade; but they soon found out how to get them tight. One point was to protect the joint from the direct rays of the sun while setting. Mr. Stone had laid several miles of cement joints, and was satisfied that they were sounder than lead ones.

Mr. G. A. Hyde, of Cleveland, treated, in a short paper, on the effect of deflection in alignment on the flow of gas in street-mains. He quoted some rough experiments with pieces of $\frac{6}{8}$-inch compo. pipe, which showed that two $\frac{1}{8}$ bends only reduced the discharge to the extent of 1 per cent., while a right-angle elbow reduced it 4 per cent. He therefore recommended using $\frac{1}{16}$ curves instead of sharp right angles for bends, tees, &c.

Mr. M'Donald commenced the discussion by questioning whether a right-angle mitre joint, as used by the author, represented exactly the same conditions as an ordinary cast-iron bend. No doubt the two $\frac{1}{8}$ bends gave appreciably less obstruction than one right-angle bend; but he did not think the difference would be so much as stated. A fairer test would be to bend a pipe to a right angle instead of making a mitre joint. Mr. Jenkins remarked that the loss was calculated on the full capacity of the pipe. In practice, the pipes were laid larger than was sufficient to carry the quantity required, in order to leave a margin for the obstruction offered by bends, tees, &c. Mr. Barnes said that a Y-shaped branch offered less obstruction than a T-shaped one; and he adopted this principle ten years ago. Mr. Thompson said that in Cleveland they had an excellent supply system. A circle of pipe, so to speak, surrounded the district; maintaining nearly a uniform pressure throughout. Parties interested in this question would do well to refer to the diagrams published by Mr. F. S. Cripps. Mr. Mayers believed in always avoiding sharp right-angle tees or bends; and Mr. Wilkiemeyer, in large pipes and joined ends. Mr. Moses said that in water-mains the rule was that the radius of the curve should be five times the diameter of the pipe; and then there was no loss by friction. Mr. Hyde replied, and said that the ordinary cast tee-piece consisted of a mitre joint; but this pattern was not used for water, in which case the branch was curved and not straight. The loss due to one bend or tee might not be of much consequence; but in practice several curves, branches, &c., followed one after the other, and a 2 or 3 per cent. obstruction at each would soon make up a considerable quantity. Obstructions of this kind on the main outlet from the works were of more consequence than on the outskirts of the district. The object of distribution was to maintain a constant pressure in all parts; and attention to this apparently trifling point would go a great way towards securing it. Of course, in some cases the expense of special castings, as compared with ordinary bends and tees, would have to be considered. He had adopted tees made on the water pattern.

The consideration of the contents of the Question-Box was then resumed; and an interesting discussion took place on the easiest and quickest means of increasing the make temporarily, in order to cope with a heavy demand, as was sometimes experienced in the winter. Mr. Whysall had found that gas could be made more rapidly from wood than from coal; but cannel, or other enricher, was necessary to bring up the quality. Mr. Hyde had resorted to resin in an emergency. It made gas rapidly, but required great care in using. Mr. Templeton had used sawdust saturated with oil; and he had also run the exhauster hard, and made up the deficiency with cannel. Mr. Thompson believed in putting by a little store of large dry coal in the summer, ready for winter emergencies. He also used cartridges made of 3-inch pipe hammered up at one end, charged with oil, and closed with a wooden plug. The wooden plug burnt out towards the close of the charge, thus liberating the oil; and the exhauster could be run faster. Mr. Witherby thought that, when it came to a case of doubt whether the holder would strike bottom before half-past ten, there was nothing the matter with a little oil and wind. He drilled $\frac{1}{2}$-inch holes in the retort-lids, and carried a $\frac{3}{8}$-inch pipe through to within a foot of the back of the retort. During the last hour of each charge, he pumped in 5 gallons of oil with a small force-pump. This plan enabled him to get over an emergency due to a crippled retort-bench. He tapped a hole in the foul main, and fixed a cock in it; and then, by speeding the exhauster, he drew as much air as the quality would permit. He used Lima crude oil—sometimes up to 20 gallons in twelve hours—and he could not say much about the quality of the gas; but he kept things going. Mr. Hyde said a great deal could be done in the way of "nursing the pressure" at the gas-works. Three-fourths of the usual supply was better than risk of total failure.

As to the best kind of boiler for averaged sized combined coal and water gas works, Mr. Guldin preferred a horizontal multi-tubular; and Mr. Moses recommended a "Hazelton porcupine." Another question was whether an existing company, with the usual charter, could stop the delivery of compressed acetylene gas by waggon service. Mr. Templeton did not believe the company could stop this any more than they could the sale of oil. It was a dangerous thing, and no doubt the sale would be prohibited or regulated in the interests of the public safety; but the gas company had nothing to do with that. Mr. Greenough agreed that no charter would be necessary for the sale of compressed acetylene gas; and therefore the gas company could not interfere. But it was so dangerous that the insurance companies and public authorities would have something to say. The President remarked that the statutes of Ohio State expressly prohibited the granting of exclusive charters of any kind.

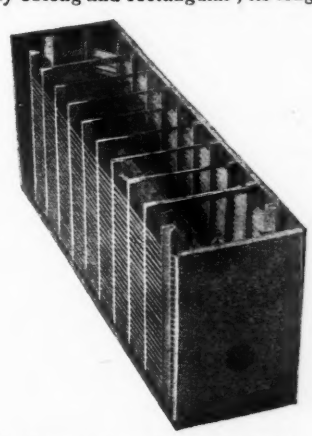
Questions as to the effect of acetylene machines on the gas business, an economical and safe process for enriching gas with acetylene, competition of natural gas used in Welsbach burners, and the protection afforded by the Welsbach Company to their agents against competition by cheap and so-called infringing incandescent burners, were discussed in private.

The officers for the ensuing year were elected; and special Committees were appointed to deal with (1) the coal tar market, (2) statistics, and (3) municipal control. The meeting then closed.

THE DOHERTY-BUTTERWORTH PURIFYING-BOX.

In the abstract report of the proceedings at the recent meeting of the Ohio Gaslight Association which appears elsewhere, reference is made to the paper read by Mr. Irvin Butterworth, the General Manager of the Columbus (Ohio) Gas Company, in which he described a purifying-box on a new principle devised by Mr. Henry L. Doherty, the Manager of the Madison (Wis.) Gas and Electric Company. In introducing the subject, the author explained that he had merely helped Mr. Doherty to work out the details of his box, and therefore could claim originality for minor points only. The fundamental theory of the box was due to Mr. Doherty, and its conception antedated the announcement of the Shelton and Beal boxes at the last meeting of the American Gaslight Association.* He then proceeded to describe the apparatus as follows:—

The Doherty-Butterworth, or "Simplex," box may be described as a vertical box with a large central submerged outlet. Its construction can be readily understood from the accompanying illustration. In the box the oxide is not spread in a horizontal bed or layer, but is placed for the most part in two vertical beds separated by a long and narrow vertical outlet "cage." The box is preferably oblong and rectangular; its length being about



PERSPECTIVE VIEW OF BOX.

three times its width and twice its height. For instance, a suitable box for a million-feet works would be about 30 feet long, 10 feet wide, and 15 feet high, and would contain about 2500 bushels of oxide. The sides, ends, and top of the box are preferably of ¼-inch sheet steel, properly braced externally; while the bottom is preferably of cast-iron flanged plates bolted together, and containing dumping-holes equipped with self-sealing doors. The box is filled with oxide through circular openings at suitable intervals in the top, also fitted with self-sealing doors, and is discharged by gravity through the dumping-holes in the bottom; the oxide above each hole being supported by a simple device independently of the self-sealing doors.

The oxide is contained in a vertical cage, built within, and a little smaller than, the box itself; leaving a gas space about 4 inches wide extending all round the box, between the sides and ends of the cage and the sides and ends of the box. Gas also

* See "JOURNAL," Vol. LXX., pp. 1175-6.

fills the space between the top of the oxide and the top of the box. This cage is of wooden frame-work, and consists of a series of upright "shutters," placed edge to edge in contact with each other, each shutter being made, for a box of the size above mentioned, of two vertical 2-inch by 10-inch timbers, about 3 feet apart, between which are nailed horizontal fixed "slats," 1 inch by 6 inches, sloping downwardly and inwardly towards the oxide, so that the latter falls freely upon them by gravity when the box is being emptied. These slats are so inclined and spaced as to prevent the oxide from falling out of the retaining cage into the gas space surrounding it, while at the same time presenting a maximum area of oxide surface for the admission of gas from this space into the oxide. Experiment has shown that the proper inclination of these slats is about 45°, while they can safely be placed 3 inches apart in a right line.

Centrally situated within this case, and completely surrounded on its sides, ends, and top by the oxide, is a large gas-outlet cage, of the same wooden shutter construction as the outer cage, but not so high. It is inverted V-shaped in cross section; the two sides of the cage meeting at the top. It runs lengthwise through the middle of the box, but is considerably shorter than the outer cage; the distance between their corresponding ends being the same as between their corresponding sides. Both cages rest directly upon the bottom of the box.

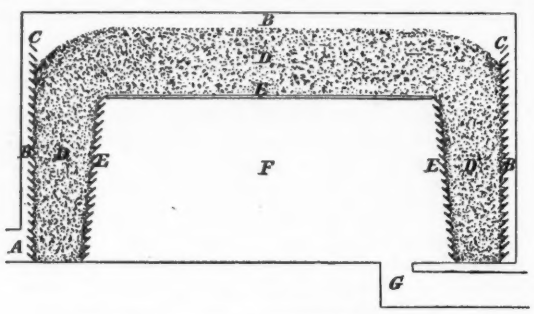


Fig. 1.—Vertical Longitudinal Section.

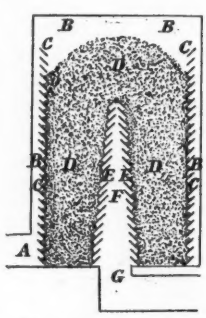


Fig. 2.—Vertical Cross Section.

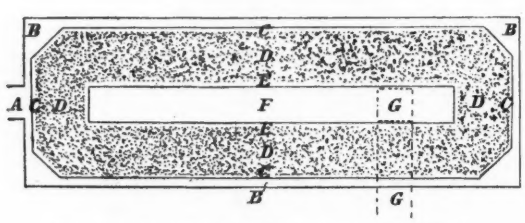


Fig. 3.—Horizontal Section near Bottom.

The operation of the box is illustrated in figs. 1, 2, and 3. Gas enters from the pipe A, at any suitable point in the sides or ends of the box, and immediately fills the 4-inch space B, surrounding the sides and ends of the inlet cage C, and also the space between the top of the oxide and the top of the box. It then enters the oxide D, through the spaces between the slats of this cage, and also from the space above the oxide, and percolates through the oxide which surrounds and covers the outlet cage E. It then passes through the spaces between the slats of this cage into the outlet space F, formed by the sloping sides of the cage, and leaves this space through a suitable opening G, in the bottom of the box, or through a flat-covered channel, with sloping sides, running horizontally out through the oxide at the bottom of the box. The oxide is preferably so disposed around the outlet cage E, that it offers an equal resistance to the passage of the gas in a straight line through the oxide from any point in its inlet surface to the nearest point of the outlet space F. In order to do this, it is necessary to so slope the sides and ends of the outlet cage as to make the horizontal thickness of the oxide less at the bottom of the box than at the top of the outlet cage. This compensates for the greater density of the oxide at the bottom, owing to the weight of the superposed material, and to the greater packing of the oxide at the bottom, due to its falling a greater distance when the box was being filled.

A series of careful experiments has been made to determine the relative quantities of gas that will pass at a given pressure through equal horizontal strata of oxide at different depths in a bed piled to a great depth. The differences in the volumes passed were not nearly so great as was expected; indicating that the density of the oxide at the bottom is not greatly increased by the weight of the material above it. The oxide is evidently not easily compressed, and it is also supported to some extent by the retaining cages as they are constructed. From our experiments we have determined that, for a box 15 feet high and 10 feet wide, which requires an outlet cage 10 feet high, the slope of the sides of the outlet cage should be about 1 inch in 12 inches—that is, the horizontal thickness of the oxide should decrease about 1 inch for every foot of depth of oxide, beginning at the top of the outlet cage. This would make the horizontal thickness at the top 54 inches, and at the bottom 44 inches; while the outlet cage would have a spread of 20 inches at the bottom. This ratio of 54 to 44 between the thicknesses of the oxide at the top and bottom will hold good for all boxes 15 feet high, regardless of their width, and also, we think, for all kinds of purifying material; but, if not, the box can be quickly, easily, and cheaply adapted to any character of material by simply changing the slope of the sides of the outlet cage. There will be no difficulty in overcoming the apparent bugbear of different kinds of materials and different densities of material between top and bottom, nor of different proportions of boxes. For a box of given width, the angle between the sides of the outlet cage remains the same for any depth of box; but this angle increases in a fixed ratio with the increase in width of the box.

If this equality of resistance is still further desired, it will also be necessary to place a vertical shutter diagonally across each corner of the box, in order to make the horizontal thickness of the oxide, at any given point between the top and bottom of the outlet cage, approximately the same at the corners as at the sides. For the same reason, the oxide would have to be piled higher directly over the outlet cage than at the sides and ends of the inlet cage—that is to say, a vertical cross section of the top of the oxide would be semicircular, while the material could be rounded down, in the same way, at the ends of the box. This can be easily accomplished, inasmuch as the oxide, in falling into the box through the openings in the centre of the top, naturally assumes somewhat this position, and its surface could be further properly shaped by the use of a hoe or "pusher" through these openings; or, if thought necessary, the right form could be easily secured to an absolute nicety by building a cheap framework, or "centre," of wood of proper form permanently in the top of the box.

On account of the restricted area of the outlet cage at its top and ends, in comparison with the inlet area of the top and ends of the mass of oxide, the flow of gas through the ends and top of the oxide will be somewhat slower than at its sides. But as soon as the outer portion of the sides of the mass of oxide, where the flow of gas is at first most rapid, begins to "cake" from deposits of the foul gas, a greater quantity of the entering gas will be forced over towards the ends and top, where the friction due to caking is less; and in this way the fouling of the oxide will automatically be made fairly uniform and complete throughout the entire mass of material, although a very small percentage of the oxide will remain partially unfouled, at the ends and top of the outlet cage, when the bulk of the material is ready for revivification. This percentage will, however, be less than that of the partially fouled oxide remaining, under similar circumstances, in the ordinary horizontal box, and can be reduced to a negligible quantity by increasing the relative length and height of the box, or by decreasing the thickness of the oxide at the top and ends, which can be done by increasing the length and height of the outlet cage.

It is obvious that the principle mentioned in the preceding paragraph, whereby the increasing friction due to the fouling of the oxide where the velocity of the gas is at first the greatest, would force the foul gas over into those portions where the friction due to caking is less—that is, where the thickness and density of the oxide are greater—and would tend automatically to secure the simultaneous fouling of all parts of the mass of oxide, even though the expedients above suggested, of sloping the sides of the outlet cage, placing vertical shutters in the corners, and rounding the top of the oxide, be omitted.

It should be borne in mind that all the woodwork in this box, including the cages, is extremely simple, and easily and cheaply constructed; and that when once in position it will never need to be moved, and will last indefinitely without repairs. The shutters of the inlet cage are easily made strong enough to withstand the lateral thrust of the oxide against them, and are held 4 inches from the sides of the box by 4-inch channel-irons at the corners of the top and bottom of the box. The slats of the outlet cage have a greater inclination with reference to the sides of the shutters than do the slats of the inlet cage, in order to compensate for the slope of the sides of the outlet cage. The shutters in each of the cages are exact duplicates of each other, and hence are interchangeable and can be quickly and cheaply made. The nails securing the slats are entirely covered by the wood, and are thus protected from oxidation. These nails are the only ironwork within the box. The cages can be retained and secured in their proper position by obviously simple means.

Some of the advantages of the box are the following:—

1.—There are no moving parts, no water-seal, no large covers to lift, no cover carriages, and only the ordinary self-sealing doors to handle.

2.—The box can be emptied quicker and more cheaply than any other, and filled as cheaply as any, by elevator or by hand.

3.—There are no trays to wear out and clog up.

4.—The entrance of the gas into the oxide is obstructed very little by trays or other woodwork. In the ordinary horizontal box, at least three-fourths of the gas inlet surface is taken up with the wooden slats composing the trays. In this box there is no obstruction whatever on the top; while on the sides and ends less than one-fourth of the inlet surface is woodwork, three-fourths at least being the oxide itself.

5.—The gas enters the oxide where it is loose and porous, on its sides, ends, and top. In the horizontal box, the gas is forced into the oxide at the bottom, where it is packed by the weight of the material above it, and through narrow spaces between the slats of the trays. The oxide filling these spaces, therefore, soon becomes caked by the absorption of sulphur and by the deposition of tarry and oily matters; and back-pressure is the result. In this box, back-pressure is reduced to a minimum.

6.—The inlet area of the oxide being so much greater than the outlet area, we obtain a much slower flow of the gas where it enters the material than where it leaves it, which is exactly what is wanted. We need the slowest velocity where the oxide is first disposed to cake; and in this box this requirement is perfectly fulfilled. The caking and back-pressure are thereby further and considerably reduced, and the duty of the material greatly increased. In the case of the box which I have already mentioned for a million cubic feet works, the area of the outlet surface of the oxide is 530 square feet, while the area of the inlet surface is about 1060 square feet. When passing gas through the box at the rate of a million cubic feet per day, its velocity would be one-fourth of an inch per second at the outlet surface of the oxide, and only one-eighth of an inch at the inlet surface. This latter rate is very much slower, and its results therefore correspondingly better, than obtains in the best modern practice with horizontal boxes. As the efficiency of purification depends wholly on the velocity of the gas, while the time between changes is determined by the thickness of the oxide, it will be seen that a box of the size mentioned—30 feet by 15 feet by 10 feet—would be amply large, and highly efficient for a million feet works. While its efficiency would be increased by increasing its length and height, the box suggested is probably of the best proportions for economical working, the average area of the oxide being 800 square feet, and its average thickness 4 feet. Its equivalent horizontal box would have to be 27 feet by 30 feet, inside measure, and deep enough (say 5 feet) to contain a bed of oxide 4 feet deep.

7.—One of the strongest points of the box is that there are no lines of least resistance for the passage, or "short-circuiting" as it were, of the foul gas from the inlet to the outlet. There are no vertical plates or box sides from which the oxide would shrink and leave an easy passage for the gas. In the ordinary horizontal box the oxide always shrinks away from the outlet-pipe and from the sides of the box, up which the foul gas then easily passes into the outlet; thus necessitating a change of boxes long before the oxide has become completely fouled. Good practice requires that in filling a horizontal box the oxide around its edges should be firmly packed by being walked upon; and a box is sometimes thrown out of circuit, its cover lifted, and the oxide around its sides re-tramped, so as to overcome, as much as possible, this difficulty. At best this requires much work, and the oxide so packed is less impervious to the gas, and therefore less efficient, than if it could remain loose and porous like that in the interior. In this box the gas cannot possibly enter the outlet without first passing through the full thickness of porous material. There are no vertical plates along which the gas may creep unpurified into the outlet, the only plate in contact with the oxide being the horizontal bottom of the box, upon which the oxide is necessarily closely and tightly packed, and from which it cannot shrink.

8.—Last, but by no means least, is the immense saving in first cost, both of the box itself and of the purifying plant as a whole. The floor space occupied by this box is exactly one-third that of an ordinary horizontal box, and seven-tenths that of a Beal box, of equal purifying capacity; and the cost of the box itself, as figured by builders of such apparatus, is about one-half that of the ordinary horizontal box, and two-thirds that of the Beal box. A purifying-house of suitable size and shape for four of these boxes, two for each kind of gas in works making a million cubic feet each per day of coal and water gas, would be 70 feet by 40 feet and have an area of 2800 square feet. One of equal capacity for four Beal boxes would be 33 feet by 100 feet, and have an area of 3300 square feet; while for the best modern arrangement of ordinary horizontal boxes the purifying-house would be 33 feet by 147 feet, and have an area of 4880 square feet. The height of the walls would be about the same for all; for while these boxes are higher than the others, there are no covers to be raised. We think, therefore, that the comparison above given for the cost of the box alone will also hold good for the purifying plant as a whole.

Fig. 4 illustrates the arrangement of the boxes in the purifying-house. Each box rests on three large I-beams, supported by a post at each end. The boxes could be placed even closer together than is indicated, except for the desirability of having ample space for handling the oxide. The proper place for revivifying oxide is in the box itself, and this is done in the usual manner by blowing or exhausting air through it in the opposite direction from that taken by the gas. The oxide floor is needed, therefore, simply for storing and pulverizing the oxide, and not for spreading it out for revivification. For this reason no great area of floor is needed. The ground floor of the purifying-house will doubtless be sufficient; but, if not, and if a cheap outside

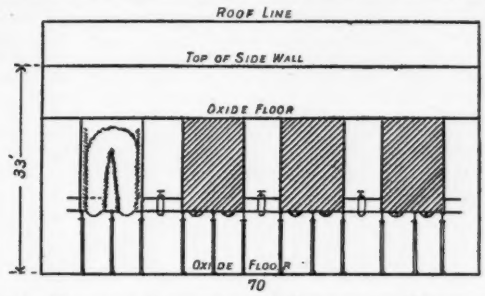


FIG. 4.—VERTICAL LONGITUDINAL SECTION OF PURIFYING-HOUSE, SHOWING ENDS OF BOXES AND UPPER AND LOWER OXIDE-FLOORS.

shed contiguous to the house is not desirable or possible, a second oxide floor can be easily and cheaply constructed on top of the boxes, as shown. Otherwise no other than the ground floor will be needed; and a large saving in cost will be thus effected. The use of this proposed upper floor would not involve any additional expense, inasmuch as the oxide must be raised to the top of the boxes any way, in order to fill them. This can be easily done by means of an inexpensive elevator; or if the boxes are to be frequently emptied, the cost of the elevator as well as its operation may be saved, and the oxide moved with economy by hand.

These boxes, like all others of sufficient capacity, should be operated in tandem, in sets of two, and not in parallel; and it is obvious that they are well adapted to any desired system of valves and connections, and to any size of works.

Acetylene in North Germany.—A company has just been formed in Hamburg to be known as the North German Acetylene Company; and an acetylene gas plant is about to be established at the State Railway station at Altona.

North British Association of Gas Managers.—The Secretary of the Association (Mr. R. S. Carlow, of Arbroath) has issued the usual circular intimating to the members that the Committee are making preparations for the annual general meeting, which will take place in Glasgow on Thursday, July 28, and the following day, and inviting their co-operation so as to render the proceedings under Mr. T. Wilson's presidency as interesting and profitable as those of previous years. A varied list of subjects is furnished to assist members in selecting a topic to bring before their colleagues.

The Franklin Institute and Holophane Globes.—The current number of the "Journal" of the Franklin Institute contains the report of the Science and Arts Committee on the merits of MM. Blondel and Psaroudaki's holophane globes. The Committee express the belief that these globes "secure much better diffusion and more satisfactory distribution" than any others known to the members, and that the invention has "secured a distinct improvement in the diffusion and distribution of artificial light." The Institute have awarded to the inventors the John Scott Legacy Medal and Premium.

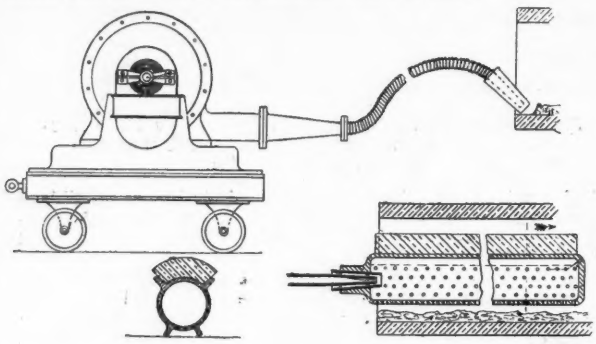
A New American Gas Association.—Under the title of the South-Western Gas, Electric, and Street Railway Association, an organization has lately been formed to embrace the territory of Texas, the Republic of Mexico, Louisiana, Indian Territory, Oklohoma, Arkansas, and New Mexico. It is an amalgamation of two previously separate Associations—one representing the lighting, and the other the railway interests. The President is Mr. Carl F. Drake, of Austin, Texas; the three Vice-Presidents being Messrs. J. H. Fitzgerald, E. Dysterod, and W. H. Weiss, representing the three interests concerned. The first meeting of the new Association took place at Laredo early last month.

The "Transactions" of the Society of Engineers for 1897.—We have received the above-named volume, which contains the record of the past year's work of the Society, under the presidency of Mr. G. Maxwell Lawford. Some of the papers read—notably one by Mr. Henry O'Connor, a Vice-President of the Society, on "Automatic Station Gas Governors," and another by Mr. R. E. Middleton, on "The Pollution of Water, and its Correction"—dealing with subjects of interest to our readers, have been fully noticed in the "JOURNAL." Mr. Middleton received the Rawlinson Premium for his contribution. The papers are illustrated by plates, where necessary. The volume, which contains a general index to the "Transactions" from 1857, has been produced under the editorship of Mr. G. A. Pryce Cuxson, the Secretary.

REGISTER OF PATENTS.

Removing Scurf from Gas-Retorts.—Billington, C., of Stoke-on-Trent. No. 7435; March 23, 1897.

This suggested method is supplementary to that described in patent No. 7286 of 1896. The patentee now proposes to rigidly attach mechanical blowers, blowing-engines, air-compressors, or the like, to a suitable platform or carriage mounted on wheels, so as to enable it to be readily transferred from place to place. The motor employed may be secured to the same platform, or to a fixed foundation. One end of a flexible metallic pipe (with swivel or socket connections) is coupled to the blower; the nozzle being tapered, and having an outer concentric casing or nozzle attached to it at a suitable distance therefrom, and projecting some distance beyond the inner nozzle. This nozzle end of the pipe is placed in the mouthpiece of the retort after the charge or coke has been withdrawn; and on air being blown through the pipes against the lower edge of the hot scurf, it is loosened or detached and partially consumed by the combined draught under pressure; the induced current of air passing through the space between the air-nozzle and the concentric nozzle or casing.



To detach carbon from the interior of through retorts, the patentee proposes to place in the retorts a steel tube, the inner end of which is solid. To the outer end of the tube is connected the nozzle of the air-conducting pipe, so that the combined air-draught forced into the interior of the tube will escape through a number of apertures formed in the pipe at any suitable angle. As an alternative, on the outer upper surface of the pipe are cast longitudinal ribs, between which are fixed fire-bricks, or other refractory material, for the purpose of protecting the pipes from the action of heat.

The illustrations represent a side elevation of the plant mounted on wheels, and having a centrifugal blower or fan and an electric motor fitted at one end of the fan shaft. One end of a flexible pipe, having a tapering metallic nozzle at its outer end, is shown connected to the outlet end of the blower. There is also a longitudinal sectional elevation of a portion of a through retort, showing the perforated cast-iron tube placed therein, and the tapering nozzle; also a transverse sectional elevation of the cast-iron tube, looking in the direction of the arrow.

Ignition Devices for Gas-Burners.—Schimmel, H., and Breslauer, E., of Berlin. No. 8083; March 29, 1897.

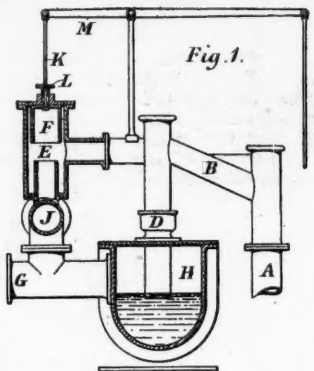
Explanatory of their invention, the patentees remark: It has already been proposed to employ highly porous carbon, and also a magnesia mixture, as a core or matrix for automatic gas-igniters. These bodies possess the property of absorbing and condensing gas in such quantity that they become, by the condensation of the gas, sufficiently heated to automatically cause a considerable rise in temperature. It is well known that silicates in the porous form are capable of condensing gases, which property, however, they do not possess to a sufficient degree to warrant their employment in the manufacture of automatic gas-ignition devices. These bodies are, however, very durable; so that experiments have been made to ascertain whether they could not with advantage be employed for the purpose. In these experiments it was shown, for instance, that the porous substance obtained by heating a mass of porcelain does condense gases, but is not capable of producing good ignition bodies. Further experiments have proved that this mass, and also silicates, could be very well employed for the purpose if the substances were used in a highly porous and somewhat concreted (fritted or slagged) form; and it was shown that this porosity can be obtained by intimately mixing the materials with organic substances such as wood-charcoal, sawdust, and the like, in the form of powder, and heating—the silicates advantageously employed being such as are not attacked by acids.

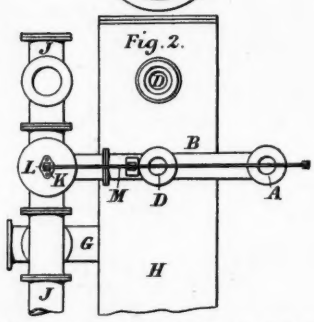
According to this invention, therefore, the cores or matrices are formed by intimately mixing the powdered silicates with the organic combustible substances named; and after they have been shaped to the desired form, they are burned at a temperature like that employed for biscuit ware. In this way, "the mass is sufficiently hardened, and acquires the desired degree of porosity by the combustion of the organic substances." The supporting wires are inserted in the plastic unburned body; and in the subsequent burning operation, the material contracts so that the wire (of the platinum group) is intimately connected with the mass of the body.

Anti-Dips for Hydraulic Mains.—Whimster, J., of Armagh. No. 10,221; April 24, 1897.

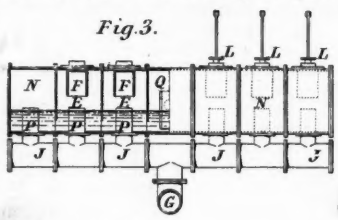
This hydraulic anti-dip for gas-works is designed for use in combination with the ordinary hydraulic main; being arranged "to provide an alternative route for the gas from the retorts to the foul main, and controlled by the opening and closing of the retort-mouth lid."

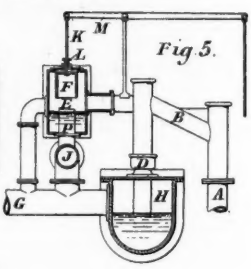
Fig 1. is an end elevation (partly in section), and fig. 2 a plan of part of a bench of four retorts, showing the simplest method of carrying out the invention. Here the gas issuing from the retorts is ordinarily carried by means of the ascension-pipes A, bridge-pipes B, and dip-pipes D, through the hydraulic main H into the foul main G. The bridge-pipe has an extra branch, communicating with an ordinary hydraulic valve E, upon the continuous or collection catch-pipe J connected to the foul main—constituting the alternative route for the passage of gas from the retorts to the foul main. The cup F of the valve E is connected by the rod K, passing through the stuffing-box L, and the lever M to the

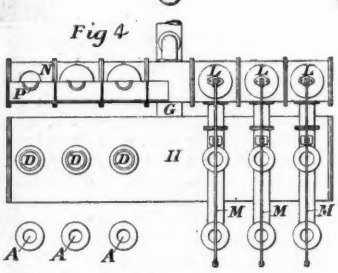




bridle of the mouthpiece lid, so that it has to be detached before the lid can be removed. The valve E is thus consequently closed, and the communication by that route cut off. When the retort is closed, the cup is lifted; and the gas, bye-passing the dip D, is allowed to get freely away without forcing the seal in the hydraulic main. If the valve were neglected to be opened again, the gas would simply take the ordinary course through the hydraulic main. A counterbalance weight may be placed upon the lever to ensure the falling of the cup when the rod is relieved, should it not be heavy enough of itself to do so.







In such a case a separate hydraulic valve is required for each retort but the patentee prefers to employ a continuous valve-box or secondary main, as shown in figs 3, 4, and 5. These illustrate a sectional elevation, plan, and end elevation of a bench of six retorts. The continuous valve-box is built up in sections N, of equal size, with a partition cast on each section. Each section is fitted with a stand-pipe P and cup F, to serve as a hydraulic valve. The centre section (not opposite a retort) is not fitted thus, but is utilized for the overflow of tar into the foul main, to be disposed of in the ordinary way. By this arrangement, the return of gas to the retorts through the overflow is prevented; also by means of the dip of the partitions and the hood Q arranged over the tar outlet-pipe, provision is made for the thick tar passing off first, and leaving the lighter tar and water to seal the cups. In the event of the middle section being required for a valve in the case of a middle retort in the oven, the surplus liquors would be removed by a sealed pipe from any of the compartments found most convenient.

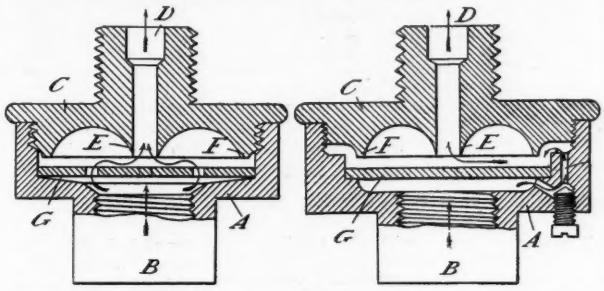
Varying the Speed of Gas-Exhausters.—Dunn, M. (late of) Selby, and Mott, W. J., of Ovenden, Halifax. No. 12,877; May 25, 1897.

The patentees do not claim any particular method of, or apparatus for, applying resistance to the brake wheel of an exhauster; but what they claim is: "Automatically regulating or varying the speed of gas-exhausters, compressors, or the like, according to the quantity of gas or the like being produced, by braking or resisting the motion of the brake wheel or its equivalent, according to the pull of the governor-bell as the

governor rises or falls." The preferred method of accomplishing this object was fully set forth in a paper read by one of the patentees at the Scarborough meeting of the North of England Association of Gas Managers—see "JOURNAL," Vol. LXX., p. 735.

Gas-Regulators.—Simmance, J. F., of Page Street, Westminster, S.W. No. 12,092; May 15, 1897.

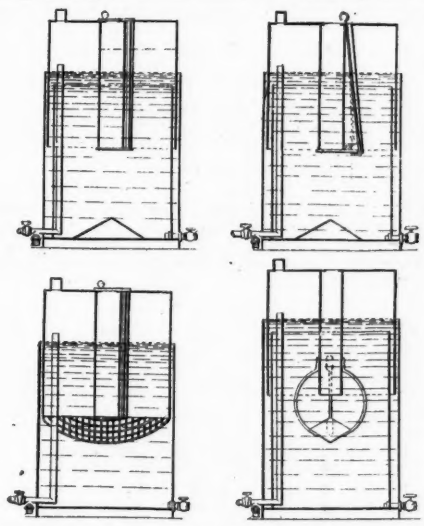
As shown, the governor comprises a cup A, with gas-inlet B, and a cover C with gas-outlet D. The cover is made with a central nipple E projecting downwards, and a lip F all round projecting to the same level as E. Within the cup (free to move up or down) is a disc G, having



through it several holes, but none of them in line with the outlet D. When the pressure varies, the disc is more or less raised towards the outlet, thus more or less throttling the passage of gas to the burner. The pressure is thus maintained nearly constant. As shown in the right-hand arrangement, the disc is made without holes in it; and a bye-pass is provided to the space above the disc, regulated by a screw plug.

Acetylene Generator.—Tyree, W., of Wellington, New Zealand. No. 28,094; Nov. 29, 1897.

This generator consists of a tank or cylinder for holding a quantity of water, into which a holder dips, and is thus sealed against the escape of gas. A trunk or pipe fixed to the top of the holder also dips in the water, and is sealed. When charging the generator, the carbide is dropped down the trunk or pipe, and falls directly into the water, and then upon a conical surface formed upon the bottom of the tank. The carbide is thus scattered towards the sides of the tank, and prevented from settling directly below the trunk. Immediately the carbide has



been dropped through the trunk, the latter is closed by a slide or trap; and the gas ascending from the carbide is thus prevented from escaping through the trunk. In order to prevent the gas escaping between the holder and tank, an inner lining is provided within the tank, leaving an annular space, wherein the holder rises and falls; and thus a seal is formed which prevents any escape of gas.

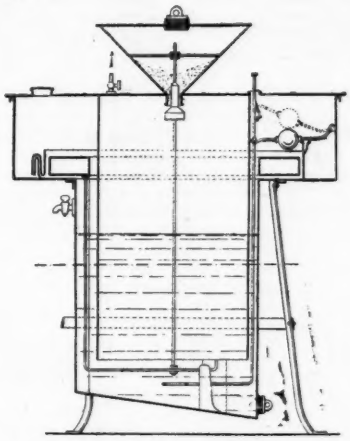
Four types of generator are illustrated. In the second case, a gravity-trap is arranged to the trunk of the generator. In the third case, the generator is arranged with a crate to hold the carbide, and the inner lining is dispensed with. In the last type, the cone is shown attached to the trunk, and operating as a trap to prevent gas ascending it.

Compressing and Mixing Gas and Air.—Leich, J., and Delporte, S., of Mons, Belgium. No. 28,368; Dec. 1, 1897.

The patentees remark that numerous systems have been suggested in recent years with the object of obtaining, by mechanical means (or by the action of a column of water, or by any other suitable method), a compression of gas more particularly intended for lighting by incandescence, for heating, and for obtaining motive power, "with the object of producing a more vivid incandescence, a higher calorific power, or a greater explosive force, as the case may be." But in all these arrangements gas alone is compressed; and the mixture of gas and air necessary for combustion is only made slowly and very imperfectly at the burner. In the arrangement which forms the object of the present invention, on the contrary, the mixture is effected beforehand in special apparatus, where the compression is also produced. The agent utilized for making the gaseous mixture and obtaining its compression is water, steam, or compressed air introduced into the apparatus by means of an injector, or more simply in the form of a "water spout." The compressor and mixer and a gasholder are placed one beside the other or one within the other; and the former has in its interior a tuyere or drawing-in pipe, a system of baffle-plates or zig-zags (one of which may be adjustable), and a series of small pipes for establishing communication between the two compartments formed by a fixed baffle-plate. The drawing-in pipe is surmounted by a tube of suitable form carrying taps for admitting gas and air respectively; and in the tube there is arranged a conical "adjutage" intended to regulate the jet of water discharged in the drawing-in pipe or tuyere. The water supply, and consequently the force of the drawing-in, is thus regulated automatically by the displacement of the bell of the holder by means of any suitable mechanism.

Generating Acetylene.—O'Brien, J. O.; a communication from E. M. Boule, of Verseilles, France. No. 29,054; Dec. 8, 1897.

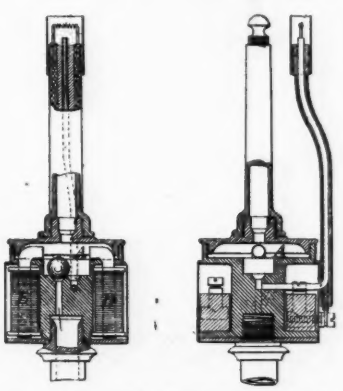
In this apparatus for producing acetylene, the gas is generated by dropping the carbide into water in a measured fall, so as to avoid over-production, and also obtain a constant pressure in the apparatus for displacing the water.



The apparatus is constructed with a cylindrical receptacle of sheet iron, provided at the top with an enlarged part, and closed by a moveable cover, upon the under side of which is affixed a second cylindrical receiver (of less diameter and depth) open at the bottom and forming a hydraulic joint or seal by means of the water contained in the receiver. Upon the cover is fixed a closed funnel-shaped hopper, into which crushed carbide is introduced through an opening in the top. Admission of the carbide to the water is regulated by a piston-valve, which acts as distributor and measurer of the carbide—being of the form of a cone surmounted by a cylindrical part capable of moving vertically in the throat of the funnel. The valve is fixed to a vertical rod at its upper end, and is connected by cross-bars and vertical connecting-rods with a flat annular float placed round the receiver in the enlarged part of the outer receiver. The bottom of this part is divided into two concentric compartments by a low circular partition, which thus forms an annular reservoir communicating with the part where the float is situated by means of a syphon. The rigid structure formed by the piston, float, and the rods which connect them one to another, may be raised (or left to act of itself) by means of a bent rod provided with a plate or ring, which projects above the cover, passing through the annular space between the two receivers.

Lighting and Extinguishing Gas-Burners from a Distance.—Guyenot, P., of Aix-les-Bains, France. No. 29,244; Dec. 10, 1897.

In this apparatus an assistant lighting-tube is used, working in combination with a platinum wire; and one of its characteristics consists of a ball-valve formed of a sphere, which is caused to pass alternately from the admission-inlet of the gas to the exit leading the gas to the self-lighter.



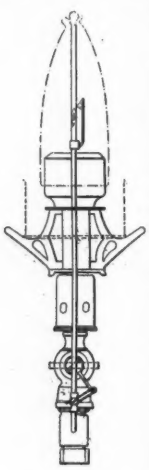
As shown, the apparatus consists of a closed chamber A, communicating in one direction with the service-pipe, and in the opposite direction with the gas-burner. In the chamber is a cap formed, for instance, of a ball or sphere, which can fall either into the seat at the end of the tube to close the same, or into a recess arranged at the side of the seat so as to free the pipe. From the recess, a pipe is continued to a small tube placed vertically at the side of, and approaching, the burner, almost at the same level. Above the upper opening or the outlet of this tube is a platinum wire or bridge joining two electrical wires, connected with the

tube in a metallic casing surmounted by a guard or socket rising above the opening of the tube and the platinum wire, so as to form around them a protective isolating chamber.

The movements of the ball-valve are obtained by the attraction of two electro-magnets D and E, arranged in such a manner that their respective cores project into the interior of the chamber A, and are more or less in line with the seat and recess. The one D (when magnetized) is intended to draw the ball-valve towards the recess; while the other (when magnetized) attracts the ball-valve towards the seat. These electro-magnets are preferably arranged parallel to the gas-admission inlet; and between them are the different terminals, &c., necessary to the joining and conduct of the wires or electric cables. The first wire leading from one of the poles extends to the bobbin D, passing the terminal, on which bobbin it is wound; thence it is connected to the wire of the platinum bridge. The other wire leading from the opposite pole is connected to the wire of the platinum bridge passing by the terminal. From a given part of the wire, another wire branches off leading to, and being wound around, the bobbin E, and connected to the main wire. The electro-magnets are magnetized separately by independent switches or commutators; one to attract the sphere to free the pipe and admit gas to the burner and to heat the platinum wire to incandescence—that is to say, to produce freeing and lighting of the burner—and the other to attract the sphere, and to close the pipe, so as to shut off gas and extinguish the flame.

Automatic Lighter for Incandescent Burners.—Landsberg, V., of Berlin. No. 29,401; Dec. 11, 1897.

This automatic lighter for incandescent gas-lamps is characterized by the connection of the main tap and automatic lighter tap by a sliding guide in such a manner that the gas is first admitted for a short time to the automatic lighter before the main tap is opened, whereupon the admission to the automatic lighter is cut off, for the purpose of preventing the gas from previously entering the incandescent body.

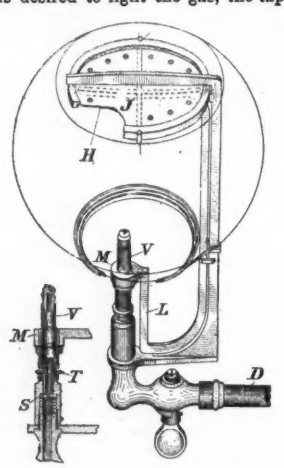


The burner carries under the tap a branch for the passage of gas to the automatic lighter. For this purpose, the tube is provided at the upper end with a fine opening, opposite which is a platinum-black lighting-pill with inserted platinum lighting wire, whereby the pill is fixed on a pill-carrier on the tube. The tube is quite outside the incandescent body, and "is placed in such a manner that the small flame touches the incandescent body only very little, in order to prevent as much as possible its unequal heating and injury."

The main tap is provided with a lever, the end of which moves in a loop of the smaller tap so that the two taps are connected together. While the former is constructed as usual, the latter has not a round bore, but a somewhat longitudinal one, which allows the tap to turn round a certain angle without the passage of gas to the automatic lighter being closed for some time. This position is used for lighting the automatic lighter; and this is effected in the following manner: On slowly turning the main tap, the smaller tap also turns. The admission to the automatic lighter is first opened, whereby, in consequence of the longitudinal slot of the small tap, gas passes for a short time to the automatic lighter, and makes the platinum wire of the lighting-pill glow, and ignites the lighting flame. On continuing to turn the main tap farther, the admission of the gas to the incandescent body is opened and lighted. When this is effected, the lighting flame goes out.

Automatic Cut-Off for Gas-Burners.—Folwell, P. C., of Toronto, Canada. No. 29,499; Dec. 13, 1897.

The object of this invention is to provide the burner of a gas-jet with a valve, which will automatically close the passage through the burner after the light has been extinguished; the action of the parts being as follows: When it is desired to light the gas, the tap is opened and the



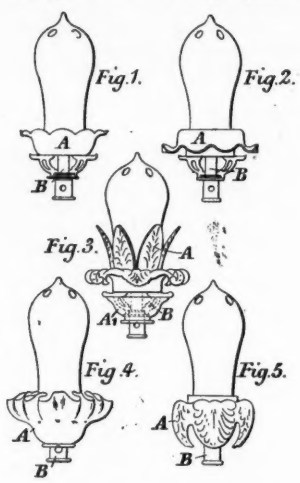
arm L is drawn downwards, causing a simultaneous downward movement of the collar M, which carries with it the burner V, valve-stem T, and valve S, and opening the passage from the gas-jet to the burner so as to allow the free passage of the gas from the gas-pipe D to the nipple-burner. The arm L, when moving downwardly, carries with it the frame J; and the diaphragm H normally resting on the frame moves with it. When the diaphragm has been influenced by the heat from the flame, it expands against the ring, and retains the frame in its downwardly drawn position. It holds down at the same time the piston-valve, keeping open the passage through the cylinder to the burner. The diaphragm is thus expanded, and held in this position so long as influenced by the heat from the ignited gas. But immediately the gas has been extinguished, the diaphragm cools, contracts, and permits of the upward movement of the frame, and the parts suspended from it, and also of the upward movement of the burner, the valve-stem, and piston-valve, so closing the passage through the cylinder.

Manufacturing Incandescent Bodies.—Bernstein, M., of Berlin. No. 29,797; Dec. 16, 1897.

This process "concerns the manufacture of incandescent bodies offering the greatest solidity possible, and bearing no prejudice to the lighting power." The substance employed for the purpose is composed of vegetable fibres, hair, or asbestos, incinerated or non-incinerated clays or earths—especially fire-brick, steatite, porcelain clay, and natural or artificial meerschaum, or of combinations of these products. The incandescent tissue is impregnated with one of the following mixtures in suitable proportions, employed in a liquid or pulverized state: (1) Zinc, zirconium, and calcium; (2) zirconium, beryllium, and barium (or cerium).

Incandescent Gas-Lamps.—Wolff, L., of Berlin. No. 29,934; Dec. 17, 1897.

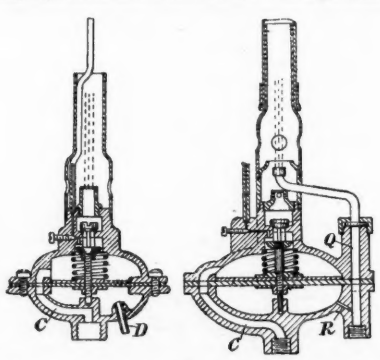
This form of lamp consists of "a light-catching cup or frill, arranged at the foot of the glass casing over or around the burner," so that the rays of light falling downwards and backwards from the source of light—that is, against the burner B—are wholly or partially caught and eventually reflected to the opposite side. The light-catching cups A may be



formed of one or more parts, varied according to circumstances or to the appearance which it is desired to give to the lamps. They are made of glass, porcelain, metal, or the like material. The light may be dulled or softened downwards or backwards; while if it be desired to reflect the light, metal or glass or porcelain covered with a mirror surface may be employed.

Igniting and Extinguishing Gas-Flames from a Distance.—Oehlmann, E. H. C., of Berlin. No. 476; Jan. 7, 1898.

In this apparatus, the outflow and ignition of the gas, and the extinction of the flame, are effected by means of compressed air or gas (or liquid under pressure) at any distance from the operating place. As shown, a chamber is arranged below the burner, and divided by an elastic plate or membrane into two parts, of which the upper part forms the gas-chamber and the lower part the fluid-pressure chamber. The gas is introduced through the passage C; the compressed air, through the pipe D. The gas-valve and bye-pass valve are arranged above each other on one spindle, which passes through, and is attached to, the diaphragm. A spring surrounds the valve-spindle; and a screw regulates the flow of gas through the ignition-tube to the igniting-jet. A gas-nozzle opens either into the mixing-tube M or into a slit burner or its equivalent.



The gas enters through C into the upper chamber, and passing the valve flows to the ignition-tube, on which a small flame is always ready for igniting the main flame. When compressed air or gas of any sort, or a liquid, under a higher pressure than the gas in the upper chamber, is introduced into the lower chamber, the diaphragm is bent upwards. In consequence the valves are lifted and the lower one closes the opening

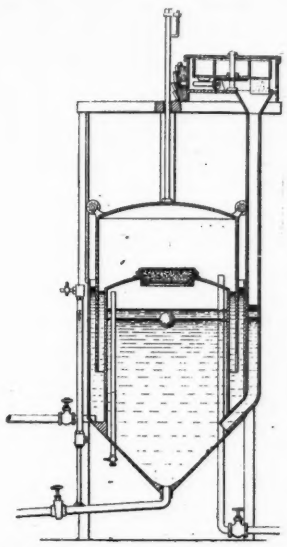
to the ignition-tube, while the upper one allows the gas to pass to the burner.

As the increase of pressure is gradual, the valves move slowly; so that while the valves are midway, gas flows to both the burner and ignition-jet, which becomes extinguished immediately afterwards, when the lower valve closes the passage. When the burner-flame is to be extinguished, the pressure is allowed to escape from the lower chamber, when the spring will depress the diaphragm again to its original position. The upper valve closes the gas-outlet to the burner; while the lower one again opens the passage to the ignition-tube. The ignition-jet is relit in consequence, so that the burner-flame can at any time be ignited again.

The right-hand illustration represents apparatus for incandescent gas-lights, in which compressed air supplied from the conduits is mixed with the illuminating gas for promoting the combustion, whereby the illuminating power of the incandescent body is said to be enormously increased. The ignition and extinction of the burner-flame is in this case effected by compressed air in the manner already described. The compressed-air conduit Q is in this case arranged at the side and communicates with the lower chamber through a small bore R.

Acetylene Generator.—Bournonville, E., of Jersey City, U.S.A. No. 1013; Jan. 13, 1898.

This acetylene-gas generator—as shown in the engraving—embraces, among other features of novelty, an improved feeder, for delivering the carbide to the tank containing the water and connected with the gas-holder.



The carbide is fed in pre-determined quantities to the tank, by means which are automatically actuated by the falling or downward movement of the holder; and the carbide thus fed from time to time, as required, is delivered to the tank through a pipe or shoot, and, owing to the form of the bottom of the tank, is deflected to a position from below the discharge-end of the pipe so that the gas arising will pass upward through the water to the holder, and be prevented from flowing upward through the pipe through which the carbide is fed. The bottom of the tank is inclined, or else is in the form of an inverted cone. The carbide is supplied in the form of lumps, and pre-determined quantities are automatically carried one after another, as required, to the shoot, and thence to the tank. The feeding-devices for supplying the carbide to the tank, after being properly charged, are operated by the reciprocating motion of the holder; and hence the carbide is fed automatically to the tank, but is not delivered until a fresh supply of gas is required for the holder.

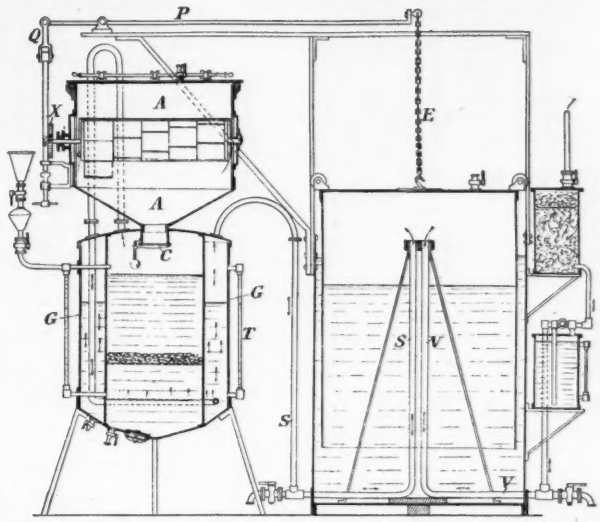
The lumps of carbide are protected from the influence of atmospheric conditions by dipping them in oil, so as to form a coating to protect them against the action of the air or liquid until they have been fully immersed in the water contained in the generator. This is claimed to be a great advantage, in that after the lumps of carbide have been introduced into the tank of the generator, the oil coating their surfaces will ascend to the upper surface of the liquid, and form a layer through which the gas must pass on its way to the holder.

Water-Meters.—Thomson, J., of Brooklyn, U.S.A. No. 1134; Jan. 14, 1898.

This improvement, broadly stated, consists in providing a water-meter with a closing cap or head, held in position under resilient pressure, which pressure is sufficient to maintain the parts in proper condition for ordinary operation, but allows them to yield under extraordinary pressure to prevent the destruction or injury of the meter, and to thereafter restore themselves automatically to position when the excessive pressure is relieved. The improvements, which are not described apart from the sheets of detail drawings accompanying the specification, while applicable to various constructions of water-meters, are more especially adapted to disc water-meters.

Producing Acetylene.—Quatennens-Moens, R., of Dixmude, and Carreer-Dilger, E., of Bruges, Belgium. No. 1665; Jan. 21, 1898.

The general arrangement of this acetylene producer is shown in the illustration; its working being as follows: Suppose the distributing drum A to be filled in its several compartments, the cover of the feeder in its place, the gas generator, the annular tank G, and the tank of the gas-holder almost filled with water, if rotary movement is imparted to the ratchet-wheel X the first compartment of the drum remains shut until the edge of its cover comes to the point where the cylindrical part of the case of the feeder ends. The cover then tips off under the weight of the carbide contained in the compartment and the carbide drops on the valve C, which opens, and it falls into the water of the generator. There is an immediate production of gas. The valve having closed instantaneously, the gas produced has but one outlet, which is the tube J, through which it travels to the bottom of the tank G, and escapes through numerous holes in the horizontal part of the tube, passes through the water contained in the tank from bottom to top, and reaches the bell of the holder (by the tube S), where it is stored and consequently raises the bell. The distributing drum is shown in such a position that the first compartment is emptied of its carbide. Owing to the rising of the bell, the lever P



oscillates, the rod Q descends through its own weight, and the pawl enters the wheel a few teeth lower. The gas passes away under a certain pressure through the tube V; the bell descending and drawing with it the chain E and the right arm of the balance. The connecting-rod Q will thereupon rise; and the pawl on the ratchet-wheel will cause the drum to turn. At a certain moment, the amplitude of the movement made by the drum will be sufficient for the edge of the cover of the second compartment to reach the edge. This compartment then empties its contents into the gas-generator, from which a fresh production of gas results, which passes into the tube J, is purified in the water of the annular tank, and gets under the bell of the holder.

Acetylene Generator.—Jacobi, G., of Dresden. No. 2309; Jan. 28, 1898.

This is an automatic apparatus for the production of acetylene gas, characterized by the arrangement that liquid carbonic acid, escaping at a uniform pressure, forces water out of a vessel into the gas-generator, while at the same time a branch stream of carbonic acid passes into the water before its entrance into the generator—dividing and distributing the same, and spreading it uniformly over the carbide. The supply of carbonic acid and water through the various tubes is regulated by stop-cocks; and the discharge upon the carbide is effected through a funnel-shaped terminal piece on the tube, so placed that it can be turned aside while the apparatus is being filled with carbide. The whole arrangement is devised to secure that "in a given time the same quantity of water will always be supplied to the carbide, so that the quantity of gas produced will remain constant."

APPLICATIONS FOR LETTERS PATENT.

8554.—Tooth, E., "Manufacture of carbide of calcium." April 12.
8555.—Tooth, E., "Illuminating and heating gas." April 12.
8565.—Lacroix, P., "Producing acetylene gas." April 12.
8568.—Benezet, D., "Generation of acetylene gas." April 12.
8591.—Crowe, R. A., "Full-way vertical-action plug-cock for fluids, steam, and gas." April 13.
8638.—Determes, P., "Manufacture of carbide of calcium." April 13.
8643.—Rea, J., J., jun., & J. S., and Dinsdale, H. M., "Exhaust silencer for gas and like engines." April 13.
8655.—Cutler, S., "Dust intercepter for water-gas generators." April 13.
8675.—Graetz, A., "Acetylene generators." April 13.
8683.—Aykroyd, J. & B., "Acetylene generators." April 14.
8694.—Miller, L. M., "Generators for acetylene gas." April 14.
8701.—Tavernor, J. M., and Levetus, E. L., "Purification and deodorization of acetylene and other gases." April 14.
8702.—Tavernor, J. M., and Levetus, E. L., "Lamps for generating and burning acetylene gas." April 14.
8756.—Sez, H., "Removing the fœtid odour of carbide of calcium, and rendering the same air-proof." April 15.
8780.—Uttley, C. H., "Production of acetylene." April 15.
8792.—Oberländer, E., "Gas savers and other appliances for preventing unnecessary consumption of gas." April 15.
8811.—Wood, J., "Generating and burning acetylene gas." April 15.
8813.—Wise, W. L., "Manufacture of gas." A communication from A. Piatti and Co., April 15.
8825.—Bowers, A. F., "Generating acetylene gas." April 15.
8873.—Young, W., Herring, W. R., and Bell, A., "Carbonizing or destructive distillation of coal shale, carbonaceous tars, and similar substances, for the production of illuminating and heating gases and water gas, and in apparatus therefor." April 16.
8875.—Holland, J., "Mantle for incandescent lighting." April 16.
8915.—Neuss, R., "Gas-burners." April 16.
8927.—Bennett, J. F., and Appleyard, W., "Electrical apparatus for gas lighting and other purposes." April 16.

CORRESPONDENCE.

[*We are not responsible for the opinions expressed by correspondents.*]

Mr. George Livesey and the Management of The Gaslight and Coke Company.

SIR,—I have read Mr. Livesey's letter which appears in your issue of the 19th; and I notice that his first shot at this Company's "Reply" only counts as "a miss," as he has aimed at the wrong target.

In the "Reply," there is nowhere any "comparison of the number of testing-places of the three Companies in relation to the *output of gas*," or any one of the figures quoted by Mr. Livesey, nor was any one of such figures either adopted or made the basis of any argument therein; and it is therefore difficult to understand why Mr. Livesey should have charged those responsible for the statements which he is criticizing in the Reply with having made an "inexcusable mistake." The figures Mr. Livesey has dealt with may be "utterly wrong" (and this may also no doubt be said of many other statements which are quoted in the Appendices); but that does not affect the accuracy of the Reply in the least degree.

In the comparison made in the "Reply," quantities of gas were not considered, but only the *distances* gas has to travel from the several manufacturing centres to the respective districts of supply, and the *areas* of those districts; and, until Mr. Livesey can disprove the contention that the greater such distance the greater in some ratio is the loss of illuminating power, the statement in the "Reply" that, "under such circumstances" as now exist, "*the gas supplied by the South Metropolitan Company is most inadequately examined*," must be deemed to be well founded.

The words in italics are the only portion of Mr. Dibdin's report which are *adopted* in the "Reply." With his figures and arguments (which covered six closely-printed sides of foolscap), the compilers of the "Reply" had no concern whatever. They, indeed, arrived at the same conclusion as Mr. Dibdin on this subject, but (as Mr. Livesey will see upon a re-perusal of the "Reply") wholly independently of Mr. Dibdin, and from considerations wholly different from his.

Mr. Livesey blames the compilers of the "Reply" for rousing that "sleeping dog" London gas-testing; but he, from his knowledge of the facts, should have foreseen, when he attacked the Directors of this Company for not showing better results from their "unrivalled district," that this question of testing-places in relation to area of supply must of necessity be again brought up, and urged as one of the reasons for the extra cost of gas supply in the North of London. Certainly no one has insisted more strongly than he upon the costliness of the process of enrichment of gas above 15 or 16 candles.

If any untoward results follow the publication of the Reply, whether in the way of increased strictness in gas-testing or in any other direction, Mr. Livesey, as the original disturber of the peace, must be held to be responsible for them.

Let me add that it is rather late in the day for Mr. Livesey to deprecate "a mere personal dispute." No one would have been more ready and anxious than I should have been to eliminate the personal element from the discussion; but, as the main objects of his onslaught were the Secretary and myself as individuals, the responsibility for the introduction of personal matters into the controversy must also rest with him.

WM. THOS. MAKINS, Governor.

The Gaslight and Coke Company,
Horseferry Road, Westminster, S.W., April 22, 1898.

The Reply of the Court of Directors of The Gaslight and Coke Company to Mr. Livesey's Strictures.

SIR,—In the "Reply" signed by Colonel Makins on behalf of the Court of Directors, some statements (see "JOURNAL," p. 834) concerning the Portland Cement Makers' Alliance call for comment.

1.—The Cement makers are condemned for uniting; and it is stated that one object of their doing so was "the restriction of" the members of the Alliance "in their purchases of coke, with a view to bring about a reduction in its price."

2.—It is argued that the Alliance, having late in 1895 agreed to buy coke of the South Metropolitan Company at 10s. per ton, there was no good reason why they should not have agreed to buy much larger quantities at 10s. of The Gaslight and Coke Company.

3.—The Alliance is accused of a system of "boycotting" Beckton coke, and of thereby being ultimately successful in stipulating for a supply of coke at a price 1s. below what they were paying to the South Metropolitan Company.

Finally, the deliberate policy of the Directors is recorded of erasing from the roll of customers of the Company, as far as possible, the members of what the Secretary and General Manager has described in correspondence with me, as that "unholy Alliance."

The proprietors who take the trouble to read the controversial literature of their Company, will perhaps be sufficiently impartial to read also what may be said on behalf of this "unholy Alliance," held up to obloquy in the Directors' "Reply."

1.—The primary object of the combination of the 24 firms which form the Portland Cement Makers' Alliance was to deal with cement questions. But for this, there is nothing to show that it would have been formed.

Joint action in the matter of purchasing materials was a subsidiary consideration; and the "restriction of the members in their purchase of coke" is not a correct description of its objects, though, as a matter of fact, voluntary joint action for self-defence very soon became necessary.

By a stretch of its monopolist power, the Company had, in the very worst depression the cement trade has known, exacted in the year 1894-5 the price of 13s. 6d. per ton of coke, which was a rise from 11s. in the year before—*i.e.*, 2s. 6d. per ton, or nearly 25 per cent. Lest it be thought that this was a natural, and not an artificial rise, or that it could possibly have been obtained from a united trade, I must explain what occurred. One manufacturer had, for reasons not apparent at the time—but since explained by him to have been his determination to get a large stock of coke, at whatever price, in order to protect himself against the Company's tactics—bid the Company 12s. 6d. for a quantity. But 1s. 6d. a ton rise was only 15 per cent, and did not satisfy the vendors, who stipulated for 13s. 6d., and obtained it. Straightway the fiat went forth that this was to be the price for all cement buyers. We were dumbfounded; but because we were scattered units, unprepared to be left without coke supplies, each was summoned to give his answer at short notice, under penalty of being cut out of the favoured list. We had to submit; and bitterly we suffered for it.

I do not think any fair-minded person will blame us for determining, when we found ourselves united in the way I have described, to present an unbroken front to the Gas Company, in order to shelter ourselves from the repetition of their merciless exaction.

The consequence was that in the following year we bought at 9s. That is why we are called "unholy," and not because the method of self-defence was not "legitimate."

2.—The reason we accepted the offer of 10s. by the South Metropolitan Company in that year was that the Company having also charged us the excessive price of 13s. 4d. from October, 1894—following the lead of the larger Company—had seen, after time for reflection, that the figure was oppressive, and had voluntarily taken off 10d. per ton on the nine months remainder of the contract quantities. Our suggestion that The Gaslight and Coke Company should follow suit was unavailing; they refused point-blank to do so.

This simple fact will show your readers the difference of the spirit in which the buyers of the two Companies are met—a difference, I am bound to add, that is consistently maintained. Is it wonderful if, when the South Metropolitan Company asked us in October, 1895, 6d. more than what we thought the proper price, we in our turn met them with a concession, and paid the 10s.; offering, however, to do the same to the other Company, albeit, as the "Reply" states, on certain "very objectionable conditions?" One condition was that we should be allowed to pay this price for three years, and thus know where we stood.

May I ask what results have accrued to the Gas Company from their refusal of this condition of our offer? Briefly these: In the year 1895-6 the Company had to store a good deal more than 100,000 tons of coke, at considerable loss for laying down and picking up, and for waste. They sold what they did sell in that year to our Alliance at 9s., instead of at the proffered 10s. In 1896-7 they sold what they did sell to us at 8s., instead of 10s.; and in the present year (1897-8), they are selling to us at 9s. 6d., instead of 10s.

I should add that when our offer of 10s., with conditions, was refused, we offered on Jan. 3, 1896, 9s. 9d. without any conditions, which was equally refused; and finding that all our efforts at conciliation were rejected, we then went for the 10d. that Mr. Livesey had given, and the Gas Company had refused in the previous year, and got it, as well as 2d. discount for cash.

Thus the "unholy" ones offered to buy a quantity that might easily in the three years have been 800,000 tons at 10s. But this having been found a "very objectionable" proposal, they have bought only 350,000 tons at an average price of 8s. 7½d., and other buyers have bought the difference at corresponding prices; showing a loss by comparison of some £55,000, apart from waste and cost of stacking. There has also been a vast amount of irksome friction, ending in litigation, due absolutely and entirely to the buyer being treated as an enemy, and his action of defending himself as not "legitimate."

3.—I have said enough to show that the charge of "boycott" is only another way of expressing intense mortification that the days of beating us in detail are over, though probably until different counsels prevail we are not safe against the Company's highly patriotic and "legitimate method" of selling coke to the foreign competitor at a less price than they exact from the "unholy" English cement buyer, should slack demand or over-supply occur, as in time it surely will.

4.—It only remains for me to notice two points.

(A) *The boasted policy that, come what may, cement makers are only to be small buyers.*—It might be inferred, from the way in which this is stated, that this process is of recent conception. That is not so. It was planned long ago, and was a ground of complaint by me, when I had an interview with the Deputy-Governor over the contract in 1896 (when they had 120,000 tons of coke in stock at Beckton alone), which was concluded at 9s. I believe he was, as I was, aiming at conciliation; and he then assured me that we might dismiss such an idea from our minds for the future, and that quantity no longer, but only the price, should be matter for contention. But alas for the fate of some good resolutions!

(B) *The system of tender.*—We should not have complained of the tender system if it had been carried out on the usual lines. But instead of allotting the coke of the successful tenderers at the prices offered, the tenders have been only used for ascertaining what highest offer the Company could get from any tenderer, irrespective of quantity, and then declining all tenders, and naming a higher price than the highest of them, as the price for all buyers.

I have shown that the methods employed by the Company, who sell nearly a million tons of coke per annum, towards buyers whom they could easily make their largest, as well as their most willing, customers for a very important proportion of it, are not to be explained on ordinary business grounds. That in the last three years they have resulted in money loss to the Company, is incontestable. That until they are changed they will continue to produce discontent and ill-feeling, is equally certain; and yet with their distrust, not to say dislike, of our "unholy" entity, how a change is to come it is not quite easy to see. Perhaps it will be when we have erected our own coke-works, and largely substituted the use of coal for coke in cement burning, and when the foreigner is unable or unwilling to import, that the leading officials of the Company, which we have been informed by the Governor is not an ordinary seller but a *quasi* Department of the State, will come to see the truth that, holy or unholy, we are human; that we need the same consideration which we endeavour to give, and generally receive, in our business relations; and that "give and take" does not, in the end, mean "give me all I want, and you shall take the rest."

I need hardly say how glad we should be if this rather gloomy forecast should be falsified by a change of policy and the adoption of such an attitude as manufacturers usually adopt towards their clients. We can assuredly say that we desire nothing better than relations of mutual concession and esteem.

FRED. A. WHITE,
Chairman of the Portland Cement Makers' Alliance.

April 15, 1898.

SIR,—There is a humour in the logic of the "Reply of the Directors of The Gaslight and Coke Company to Mr. Livesey's criticisms" in respect of the dealings in coke with the Cement Makers' Alliance, that deserves a few words of notice.

The Alliance, it seems, in October, 1895, tendered for Beckton coke at 9s. 6d. The Directors offered to supply it at 10s. The Alliance agreed to the price if it was fixed for three years; and, on that being refused, 9s. 9d. for one year was subsequently offered. The Directors preferred to stock their coke rather than sell it on these terms. They spent a heap of money in this operation; incurred heavy loss in wastage; and after all sold to the Alliance for the three years now nearing their end at 9s., 8s., and 9s. 6d. Most people would think that the event has shown that the Alliance made the Directors in 1895 exceedingly liberal offers, and that it was unwise of the Directors to have refused them. But no! The Directors hold that they were subjected to a system of "boycotting" and (here is the cream of the joke) *on that account* decided to give a wide berth to their best and nearest coke customers, who would, if they had been allowed, have paid the Directors a better price than could be got elsewhere, and kept Beckton clear of stock throughout.

Now what is the position to-day of the customers who have been thus deliberately thrown over for "a large and profitable extension of export-trade?" We all know that in 1894, when—in face of cheap coal and slack trade—Beckton coke was forced up to 13s. 6d., the cement makers were at their wits' end to carry on their business at all. The Gas Company's books would show that more than one firm was in that year unable to fulfil its onerous coke contract. To-day, happily, all this is changed; and it is matter of notoriety that, with increased business and higher prices for their product, cement makers are in a position—a better position than export buyers can possibly be – to do with the Gas Company "a large and profitable" business in coke.

It is too late for the Directors to correct the mistake made in 1894; but they can take consolation in the fact that all coke-users in the Metropolitan districts feel grateful for the results of the mistake. It is not too late for them to do a really good business with their old customers, the cement makers, in the present and future years.

COKE BUYER.

April 23, 1898.

The Desirability of Harmonious Relations between Gas Companies.

SIR,—While not questioning the right of any shareholder to criticize the official acts of Boards of Directors, especially when done with laudable intentions (by which I am reminded of a certain place resembling, in the main, a retort-house, which is paved with such non-vendible articles), I venture to think it a sorry spectacle to be compelled to witness the feud between two of the London Gas Companies at the present time. Whether the Metropolitan "Codlin" south of the Thames or the Chartered "Short" north of the river is our best "friend," I will not attempt to determine. You make your investment, and take your choice; but, Sir, is not such debate to be deprecated? Is it not playing into the hands of the "Bears," causing the enemy to rejoice, and righteous shareholders to blaspheme? The average fall in the value of the "A" stock since February exceeds 10 per cent., due, I take it, to attacks from within and not assaults from without. This, too, with the enemy in sight, and rival processes of artificial illumination on all sides of us!

I am persuaded that this altercation between the northern and southern Companies is not calculated to advance the high estimation which gas property has hitherto enjoyed in the market. In my humble opinion, the Metropolitan, and in fact *all*, Gas Companies should, as far as possible, dwell in harmony and good-will towards one another. From the shareholders' point of view, "'tis a consummation devoutly to be wished."

C. E. JONES.

April 22, 1898.

Absorption of Water by Coke.

SIR,—I notice the old story about coke absorbing up to 20 per cent. of water has cropped up again; and further that Mr. H. O'Connor claims to have made some experiments which substantiate this ridiculous conclusion. It seems as absurd on the face of the thing to suppose that 16 cwt. of coke could under any circumstances carry 4 cwt., or 44 gallons, of water, as that a process of "picking" the coke with a view to defrauding a large customer could be successfully carried on for any length of time without detection. If there is anything like this action, statistics as to coke sold are utterly valueless. I contend that the experiment quoted by Mr. Lyon represents the facts of the case. It would be impossible to sell coke containing even 10 per cent. of water without complaint from the customer. On one occasion a large customer, a gentleman of some scientific eminence, complained that the coke supplied to him was delivered in so wet a state that the water ran out of it, and when placed in the stove *it put the fire out*. He placed several lumps in the drying oven, and produced figures showing just under 10 per cent. of moisture. Inquiry proved that the cart was loaded during wet weather, from a low place where the coke had been submerged for some time; and that it was exposed to a heavy shower during delivery. The matter was settled by allowing 10 per cent. discount, and sending men to take the wet stuff from the cellar and expose it to the air under a shed. The coke was then fit for use in a few days.

I happen to be interested in two small works a few miles apart, where the same description of coal is used. At one it has always been the rule to store the coke under cover; at the other it is kept in the open. According to Mr. O'Connor, the sales per ton of coal carbonized should be substantially higher at the latter works. But records extending over fifteen years show no appreciable difference.

I have repeatedly taken coke from the yard, where it has been stored in the open for various lengths of time, and dried it by exposure to 212° for some hours, or as long as it would lose weight. The results of these experiments have always been to show that the expression "absorption of water" is a misnomer. If wet to the touch, as when fresh from a shower, a quantity of moisture would be retained on the surface, ranging from 2 per cent. with large lumps to 5 per cent. with small. This passed off rapidly; and afterwards the loss was a mere fraction of 1 per cent.

The differences due to weight, as compared with measure, are entirely a question of large or small lumps. Fresh coke is larger, and therefore sells out better by measure than that which has been stored. Coke customers never object to that stored in the open, on the score of moisture; and I would defy anyone to run an ordinary coke trade successfully with coke that averaged over 5 per cent. of moisture.

N. H. HUMPHRYS.

Salisbury, April 20, 1898.

The Abolition of Meter-Rents.

SIR,—This question is well worth ventilating, inasmuch as uniformity in practice is much to be desired, and should be secured, if possible, by purveyors of gas. It is unfortunate that meter-rents were ever imposed on the consumer; and, as you will readily conceive, I advocate their abolition, as also the charge for "fixing meters."

I am not unacquainted with the gas industry, nor ignorant of its weak points; and it seems to me that it is as reasonable for traders to charge their customers separately and individually for the use of their weights and measures as for a gas undertaking to collect meter-rents. No charge is made for the chaldron to measure coke. Why then should the meter be the subject of rent to measure gas? New meters, like mains, are a capital charge, and should be treated like the latter, and renewed accordingly.

In some of my public utterances, I have advocated these views; and had meter-rents been included in the price of gas long ago, instead of being charged separately, I am convinced an immense expansion in gas supply would have been manifest, not only in domestic use, but in its growing application as fuel, a workshop tool, cheap motive power, &c., with advantages to the industry and allied trades, the abatement or removal of smoke in towns, and the prolongation of dear life.

C. E. JONES.

April 22, 1898.

PARLIAMENTARY INTELLIGENCE.

HOUSE OF LORDS.

The following further progress has been made with Bills:—

Bills brought from the Commons, read the first time, and referred to the Examiners: Hartlepool Gas and Water Bill, Ilkeston Corporation Bill, Southend-on-Sea Gas Bill, Tottenham and Edmonton Gas Bill.

Bills read the third time and passed: Bakewell Gas Bill, Stirling Gas Bill.

The Margate Corporation have petitioned against the Thanet Gas Bill.

HOUSE OF COMMONS.

The following further progress has been made with Bills:—

Bills brought from the Lords, read the first time, and referred to the Examiners: Bakewell Gas Bill, Stirling Gas Bill.

Bills read a second time and committed: Drogheda Gas Bill, Edinburgh and District Water Bill, Edinburgh and Leith Corporations Gas Bill, Folkestone Gas Bill, Mid-Kent Water Bill, Morley Corporation Gas Bill, Swansea Gas Bill, Waterford City Gas Bill, Yeovil Corporation Bill.

Bill reported, with amendments: Aberystwyth Gas Bill.

Bills read the third time and passed: Crawley and District Water Bill, Hartlepool Gas and Water Bill, Ilkeston Corporation Bill, St. Anne's-on-the-Sea Gas Bill, Southend-on-Sea Gas Bill Tottenham and Edmonton Gas Bill.

The Brompton &c., Water Bill, the Clacton-on-Sea Gas and Water Bill, the Cranbrook District Water Bill, the Haslemere District Water and Gas Bill, the Higham and Hundred of Hoo Water Bill, the Mid-Kent Water Bill, the Southend Water Bill, and the Wey Valley Water Bill, have been referred to a Select Committee, consisting of Colonel Gunter (Chairman), Sir L. Lyell, Mr. Seely, and Mr. Phillips; to meet on Wednesday, April 27.

The petition presented by the Gainsborough Gas Company for leave to introduce a Bill to enable them to increase their capital has been referred to the Select Committee on Standing Orders.

Petitions against the Edinburgh and District Water Bill have been presented by Major Gibsone and the Clippens Oil Company.

Petitions in favour of the Rhymney and Aber Valleys Gas and Water Bill have been presented by the Urban District Councils of Bedwellty, Caerphilly, and Rhymney, and by the Rural District Council of Gelligaer and Rhigos.

Reductions in Price.—On the recommendation of the Gas Committee, the Smethwick District Council have reduced the price of gas used for gas-engines to 2s. 1d. per 1000 cubic feet, less the usual discount. The Gas Committee of the West Bromwich Corporation have resolved to allow a discount of 5 per cent. from the new scale of charges for gas used for motive power purposes, instead of such charges being net, as before.

Sales of Shares.—In accordance with the announcement which recently appeared in the "JOURNAL," Mr. R. Mack sold by auction last Wednesday, at the offices of the Newcastle and Gateshead Gas Company, £26,600 of 5 per cent. preference stock of the Company; being the remainder of the £50,000 additional ordinary preference stock authorized by a resolution passed by the shareholders early last year. There was a large attendance. It was put up in £100 lots. The first lot was sold for £153 10s.; after which a number of lots were sold at £157 and £157 10s. The latter was the highest offer obtained; and the price gradually declined to £135, which was the lowest, though a large quantity was disposed of at this figure, and at a slight advance upon it. The largest sale was at £135 5s., at which price £5000 worth of stock was disposed of. The amount realized was £38,183 17s. 6d., being an average of £143 11s. per £100 lot. On the following day, 150 new shares of £10 each in the Dover Gas Company were disposed of at prices ranging from £18 17s. 6d. to £19 5s. per £10 share. At a recent sale of shares at Richmond, £70 worth of "A" stock in the Richmond Gas Company realized £195; while £55 was paid for "B" stock in the same Company of the value of £20.

LEGAL INTELLIGENCE.

LIVERPOOL COUNTY QUARTER SESSIONS.

Thursday, April 21.

(*Before Mr.* T. M. MARSHALL *and a Bench of Magistrates.*)

Liverpool Corporation and the Prescot Water Supply.

To-day the Bench had before them an appeal by the Liverpool Corporation against a conviction by the Prescot Justices for failing to furnish a sufficient supply of water to the Conservative Club, Prescot, and the infliction of a penalty covering a period of 60 days, at the rate of £2 for the first, and 1s. for each succeeding day (*ante*, p. 286).

Mr. PICKFORD, Q.C., and Mr. SWIFT appeared for the Corporation; Mr. TAYLOR, Q.C., and Mr. COLLINGWOOD HOPE represented the club.

Mr. TAYLOR said the club was situated in a district supplied with water by the Liverpool Corporation, who were the water authority of the district. It was now supplied from a high-level tank, into which, down to November, 1897, water was pumped only between six in the morning and six in the evening. During the night the district was supplied, prior to that month, by gravitation from the reservoirs. While this method was practised, there was no supply of water during the night on the first and second floors of the club, on the former of which the bar, lavatory, and baths were situated. In 1896, by arrangement with the Corporation, two cisterns, jointly capable of holding upwards of 300 gallons, were placed on the upper floor for the storage of water; but still there was no supply during the night. This state of things was tolerated by the club because they did not understand that they were entitled to demand a better service. Attention was directed to the rights of the people of Prescot by what was known as the Brady case, which commenced in the Prescot Police Court, and went to a Divisional Court of the High Court of Justice, where it was decided that, under section 32 of the Corporation Act of 1866, which was operative to the exclusion of section 25 of the Act of 1862, the Corporation were bound to furnish a constant service of water at such a pressure as to reach the top storey of any house situated within a district supplied by them, unless the service were interrupted by frost or drought.* After this decision, complaints were made to the Corporation, and correspondence ensued, during which the Town Clerk wrote that steps would be taken to furnish a sufficient flow of water to the premises in conformity with the decision of the Divisional Court. The Corporation then commenced to pump water to the high-level tank during the night as well as in the day, so that at night water did flow into the club cistern in larger or smaller quantities. In the daytime, however, when water was being drawn in any quantity by consumers in the lower portion of the township, there was not a sufficient supply for the ordinary domestic uses of the club.

In support of the respondents' case, the Secretary, Manager, and Chairman of the club were called, and gave evidence showing that the supply was inadequate.

Mr. *J. Kirby*, Water-Works Superintendent at Prescot, for the appellants, said he had not received any complaints about the service since they commenced pumping into the high-level tank night and day. He visited the club on two occasions, and found the cisterns nearly full. In cross-examination, he said he had been told by the Manager that since the change the supply at night was good, but was insufficient during the day.

Mr. *J. Parry*, M.Inst.C.E., Corporation Water Engineer, stated that the present appliances at Prescot, when worked to their full capacity, were sufficient to serve every house, with the exception of three. One of these was the Conservative Club, which could not be fully supplied at certain periods of the day, when consumers in the lower parts of the town were drawing heavily. To supply these three buildings it would be necessary to erect a higher tank, or to lay a special main to the houses. The club cistern was higher than any other in Prescot; and the ball-cock was on the same level as the base of the high-level tank from which it was supplied. In cross-examination, he said he did not think it necessary to lay a larger main in High Street in place of the existing 7-inch pipe, as the supply was now equal to the present demand, except in regard to the three houses referred to. He could not say whether the supply would be sufficient if the inhabitants used more water for baths.

The CHAIRMAN intimated that the Bench were satisfied that the supply of water to the club was, in fact, insufficient for domestic purposes.

Mr. PICKFORD then addressed the Court on behalf of the Corporation. He first raised the technical objection that, while the conviction imposed a fine for the period between Nov. 4, 1897, and Jan. 23, 1898, the water-rate of the club was not paid till Nov. 16. The Corporation were not obliged to supply water until the rate was paid; and the conviction therefore, he contended, was bad. Proceeding, he submitted that the Corporation's obligation to furnish a sufficient supply of water was limited by the capacity of their present works and apparatus when worked to their full power. They could not increase their works without parliamentary authority; but if the contentions of the respondents were correct, the Corporation might be obliged to erect new works as time went on. If seven or eight storey buildings, after the American style, were erected at Prescot, the Corporation, according to this contention, would have to provide new appliances to supply the top storey of these buildings with water, though they had no authority to provide such new works. They would accordingly be placed under enormous obligations, and have a perpetual daily fine imposed on them which they could not avoid. The case was not quite similar to that of Brady, as the present works of the Corporation in the district were found to be sufficient to give him an adequate service.

Mr. TAYLOR, in reply, contended, with respect to the technical objection, that the Act merely provided that a man must pay his rates before he could claim a penalty.

The BENCH, after consultation, dismissed the appeal, with costs; but a case was granted for a Superior Court.

*See "JOURNAL," Vol. LXX., p. 1009.

Actions for Damages Caused by a Gas Explosion.

An action was lately brought against the Ballynahinch Gas Company by Mr. John Hughes, to recover damages, laid at £100, for personal injuries caused by the alleged negligence of the defendants. Plaintiff was employed on the new works of the Belfast Water Commissioners, and on the 8th of January last he was in the shop of a Mr. Norwood, a barber, in Ballynahinch. There was a strong smell of gas; and Mr. Watson, the Gas Manager, was sent for. While he was trying to discover the escape, an explosion occurred. Plaintiff and some others were injured, and the interior of the house was wrecked. Plaintiff was for five weeks under medical treatment, and had been unable to do any work since. The Jury found for the defendants. In another case, brought by a man named Roy, a similar verdict was taken by consent.

Emission of Smoke from Manchester (Bradford Road) Gas-Works.

At the Manchester City Police Court last Wednesday, the Manchester Corporation were summoned, at the instance of Inspector Rowe, of the Corporation Sanitary Department, as a private inhabitant of the city, for causing a nuisance by smoke at the Bradford Road Gas-Works. In January the Magistrates made an order of abatement upon the Corporation; and on March 14 Mr. Rowe took observations, and reported four minutes of dense smoke in half-an-hour. Mr. T. Miller, Assistant Solicitor to the Corporation, who appeared on their behalf, read the following letter from the Lord Mayor (Alderman Robert Gibson), who is Chairman of the Gas Committee: "As you know, it is the meeting of the Council to-morrow, and so I cannot attend Court, or I should certainly do so. I should like personally to explain to the Magistrates the extreme difficulty of our position, and how a gas-works of such dimensions cannot at all fairly be treated as an ordinary works or factory. Here we carbonize 150,000 tons of coal a year—a plant equal to making 8 million cubic feet of gas per day; and there must be some smoke with all this work going on. The fact is it would be just as sensible to require a miller not to make any dust. As a matter of fact, we have the best smoke-prevention appliances; we burn nothing in our fires except coke—not an ounce of coal. I have now, or rather a few days ago, given instructions to our new Deputy-Manager to do all he can to have as little smoke as possible pass; and we cannot do more. Indeed, as we do not burn coal in any of our furnaces, I utterly fail to see how black smoke can be emitted, except in the ordinary process of carbonizing." Mr. Headlam said the Court could hardly accept the defence, and fined the Corporation 20s. and costs.

The Pollution of the River Wye by Gas Liquor.

In the Queen's Bench Division of the High Court of Justice last Saturday, the Mayor and Corporation of High Wycombe, who had been fined £2 and £1 19s. 6d. costs by the Petty Sessions Court of the borough, at the instance of the Conservators of the Thames, under the Thames Conservancy Act of 1894, for wilfully suffering a large quantity of offensive matter to pass from their sewage works into the stream of the River Wye, a tributary of the Thames (see *ante*, p. 81), appealed against the conviction. The facts were briefly as follows: On the morning of Dec. 7, 1897, a large quantity of ammoniacal liquor from the works of the High Wycombe Gas Company, situated about 1½ miles from the sewage works, was discharged into the sewers, and caused offensive smells to proceed from the manholes, and to prevail at the sewage farm of the Corporation, who are the Urban Sanitary Authority of the district. The offensive odour was brought under the notice of the Borough Surveyor and the foreman of the sewage farm and outfall works; and the latter scattered some disinfectants about. Nothing, however, was done to extend the area of filtration; and the result was that large quantities of offensive substances passed into the Wye, and killed a number of fish. The Gas Company were proceeded against by the Conservators and fined; and then action was taken against the Corporation, who contended that they had not been guilty of wilfully suffering the polluting fluid to flow into the stream, and that they were not responsible for the wrongful act of the Company. Their officials, they said, had been taken by surprise; and if they did not do anything during the few hours the liquor was passing through the farm, to prevent it getting into the river, it was at most an error of judgment. The Conservators however, contended that the Corporation were guilty of an offence. Mr. Bray, Q.C., and Mr. David appeared for the appellants; Mr. J. E. Bankes represented the respondents. The Court (composed of Justices Grantham and Kennedy) held that there was not sufficient evidence to show that the appellants wilfully suffered, within the meaning of the Act, the flow of offensive matter into the stream; and they quashed the conviction.

The Clacton District Council and the Gas and Water Supply.—A well-attended meeting of owners and ratepayers of Clacton-on-Sea, convened at the instance of the District Council, was held at the Town Hall last Tuesday, to consider the provisional agreement entered into between the Council and the Gas and Water Company for the acquisition of the Company's undertakings, at a price to be agreed upon or settled by arbitration (such price to include a sum of £4000 to cover back dividends and compensation to Directors and officers of the Company); and the Council's application to Parliament for confirmation of the agreement, and for other powers. Mr. T. H. Baker (Chairman of the Council) put the case clearly and exhaustively before the meeting, and mentioned that the Council were advised to ask for sufficient power to enable them to supply water to a population of 50,000 people at the rate of 18 gallons per head per day. He proposed the following resolution: "That this meeting of owners and ratepayers of the district of Clacton approves of the provisional agreement for the purchase by the Council of the undertaking of the Clacton-on-Sea Gas and Water Company, and also of the application to Parliament by the Council for power to carry out the purchase, for the construction of additional works, for obtaining further supplies of water from Great Bentley, and for powers to raise the money necessary for these purposes;" and it was carried unanimously.

MISCELLANEOUS NEWS.

THE PROJECTED ACETYLENE GAS EXHIBITION AT THE IMPERIAL INSTITUTE.

Rules for the Admission of Apparatus.

In the "JOURNAL" for the 12th inst. (p. 825), it was announced that the Council of the Imperial Institute had authorized the holding of an exhibition of apparatus and appliances for the generation of acetylene gas, and its application for lighting purposes, in the grounds of the Institute at an early date, and that the Council of the Society of Arts had appointed a Committee to settle the conditions under which such apparatus should be admitted. The following are the names of this Committee: Major-General Sir Owen Tudor Burne, G.C.I.E., K.C.S.I. (Chairman of the Council); Sir Frederick Bramwell, Bart., D.C.L., F.R.S.; Professor James Dewar, M.A., F.R.S.; Mr. H. E. Jones, M.Inst.C.E.; Professor Vivian B. Lewes, F.I.C., F.C.S.; Professor Boverton Redwood; Professor W. C. Roberts-Austen, C.B., F.R.S.; Professor J. M. Thomson, F.R.S.; and Sir Henry Trueman Wood (Secretary). We have now received the prospectus of the projected exhibition, from which we learn that the Committee have, for convenience of classification, divided the generators into three groups: (1) Those in which the gas is generated by water being allowed to drip, or flow in a small stream, on to the top of the carbide. (2) Those in which water rises around the carbide. (3) Those in which the carbide falls into water. These are again sub-divided into "Automatic" and "Non-Automatic." By automatic generators are meant those which have a storage capacity for gas less than the total volume which the charge of carbide is capable of generating, and which depend upon some special contrivance for stopping contact between the water and carbide when the consumption of the gas ceases. Non-automatic generators are those in which a holder of sufficient capacity is provided to receive the whole of the gas made from the largest charge of carbide which the apparatus is capable of taking.

The following are the conditions laid down by the Committee which the apparatus admitted to the exhibition of generators will be required to fulfil:—

Automatic.

1.—Under no condition likely to occur in working must it be possible for the pressure in any part of the apparatus to exceed that necessary to support a column of water 100 inches in height.

2.—When the apparatus is first charged, in no case must the air in the generating chamber and receiver exceed one-fifth of the capacity of the apparatus.

3.—On shutting off the outlet-cock of the generator, the generation of the gas should be so speedily arrested that no large escape of gas may need to take place. But in any case there must be an arrangement by which any surplus gas can be delivered outside the building.

4.—The apparatus should be so arranged that the decomposition of the carbide should not give rise to excessive heating.

Non-Automatic.

1.—Under no condition likely to occur in working must it be possible for the pressure in any part of the apparatus to exceed that necessary to support a column of water 100 inches in height.

2.—The air space in the generating chamber should be as small as possible, and the apparatus should be so arranged that the decomposition of the carbide should not give rise to excessive heating.

3.—There must be some arrangement by which, if the delivery pipe from generator to holder becomes choked, the gas can escape by blowing a seal or by driving back feed-water and escaping through the tank.

The Committee will test, prior to admission to the exhibition, all apparatus intended to be shown in operation. For this purpose the London County Council have given permission to the Committee to use a portion of their premises at 211, Harrow Road, London. The tests made by the Committee are intended to show which generators are so constructed as to be safely admitted to work at the exhibition, and do not imply any special approval on their part in any other respect.

A daily record will be kept of all apparatus at work, in accordance with directions to be laid down by the Committee; and a report will be issued on the results of the working. A certificate will be given in respect of each generator at work.

It is intended that the exhibition of apparatus at work shall commence on the 1st of June, and continue open until the end of August. This term may be extended for a further period, not exceeding three months, if in the opinion of the Council of the Imperial Institute such extension should be desirable. The public will be admitted free daily, from 11 a.m. till 1 p.m., and by payment from 1 p.m. until 11 p.m., except on Wednesdays; this day being reserved for Fellows of the Institute and their friends. Facilities will be afforded for lectures, discussions, &c.

A structure, freely open on all sides, called the Generator Building, will be erected in the South-west Quadrangle of the Institute, under which the apparatus is to be exhibited in operation. Each apparatus will be connected by its own separate service-pipe to its own 7-light gaselier inside one of the ground-floor exhibition galleries of the Institute, so that the lighting power of the gas may be shown. The intention is that the apparatus of each individual exhibitor shall represent, as nearly as possible, the requirements necessary for a complete installation of acetylene gas for lighting purposes. Arrangements have been made with the Acetylene Illuminating Company, Limited, the manufacturers of carbide of calcium at Foyers, Scotland, for a supply of carbide, which will be furnished by the Executive to exhibitors in quantity sufficient for the service of one 7-light gaselier, through burners not consuming more than 1 cubic foot of gas per hour each, for an average not exceeding five hours per day. The only acetylene light allowed in any part of the buildings or grounds will be that shown through the gaseliers above mentioned, unless by special consent of the Executive Council. With the exception of the electric light, no artificial light or fire of any description will be allowed in the building.

THE SWANSEA CORPORATION AND THE GAS COMPANY.

Contemplated Appeal against Mr. Justice North's Decision.

At the Meeting of the Swansea Corporation last Wednesday, the Parliamentary Committee presented a report on the recent proceedings against the Bill promoted by the Swansea Gas Company (*ante*, p. 719). It may be remembered that the Committee of the House of Lords who considered the Bill decided against the Corporation on all contested points. Nevertheless the Parliamentary Committee of this body regard the result, on the whole, as satisfactory.

The Corporation first objected to a clause for the consolidation of the Company's capital, on the ground that it would increase the reserve fund and the borrowing powers, for which the consumers would have to pay. In the result, clauses were inserted preventing an increase of the reserve fund in respect of their capital existing at the time of the passing of the Bill; and the borrowing powers sought were also considerably curtailed. On the second point, the Committee claim that the Corporation have gained the concession that all new capital should be put up for auction, and allotted to the highest bidder, subject to any previously arranged reserved price. Thirdly, the Company are prohibited from converting borrowed capital into shares. The fourth point constituted the principal objection of the Corporation. It arose on clause 9, "which clause," the Committee say, "made the dividends payable to the shareholders dependent upon the price charged for gas; and if the Bill had been allowed to pass into law as it then stood, the Company could have increased their present maximum dividends annually by 15s. per cent. at the cost of the consumers, without making any reduction in the price charged for gas. As a result of the opposition of the Corporation, this obnoxious clause has been eliminated. It was further contended, on behalf of the Corporation, that the maximum price for gas should be the same—viz., 3s. 6d. per 1000 cubic feet—throughout the whole borough, and not merely in the borough, as it existed before it was extended by the Swansea Corporation Act, 1889. A clause is now inserted which places the whole borough on an equality in this respect."

The objections that failed were (1) that the increase of capital was excessive; (2) that a testing-place should be provided in some central position, and not at the works of the Company; (3) that there should be an independent audit of the Company's accounts in the interest of the consumers; and (4) that a clause should be inserted protecting the existing rights and interests of the Corporation. The Committee regarded these as matters of considerable importance; but the Committee of the House of Lords refused to amend the Bill so as to remove these objections. The points, however, upon which the Committee have been successful are held by them to be of far higher importance, and a great saving to the consumers.

Referring to the decision of Mr. Justice North, who ruled that, the provisions of the Borough Funds Act not having been complied with, the Corporation could not pay any of the costs of the opposition out of the borough fund, the Committee say: "They regard the judgment as prejudicial in the extreme to the interests of municipalities, as it is quite impracticable, and oftentimes it would be impossible, irrespective of the enormous expense it would entail, to comply with the provisions of the Borough Funds Act in time to oppose the Bill in Parliament. Your Committee are informed that steps are now being, and have for many years been, taken by the Association of Municipal Corporations to obtain an alteration of the law in this respect. They, however, think that the correctness of the decision of Mr. Justice North is open to considerable doubt; and steps are, therefore, proposed to be taken, subject to the advice of eminent Counsel, with a view to an appeal against such decision. Your Committee are not averse to the principle of consulting the ratepayers upon the question of promoting or opposing a Bill in Parliament; but they are unanimously of the opinion that a poll should not be necessary unless it is demanded by a substantial number of owners and ratepayers. Your Committee, while regretting the result of the legal proceedings before Mr. Justice North, are nevertheless satisfied that the opposition of the Corporation to the Bill of the Gas Company has been fully justified, and that if the Bill had been allowed to pass into law unopposed, and without the amendments which have been made, the results would have been most disastrous, not only to every consumer of gas, but to the whole borough."

A motion for the adoption of the report was submitted by the Mayor (Mr. J. A. Thomas). He said it was the duty of the Corporation to appeal against the decision of Mr. Justice North, and to know exactly their rights in the future—whether before going to Parliament to oppose a Bill they must call a meeting of the ratepayers, any single one of whom could demand a poll, which would cost the Corporation a great deal more than any reasonable opposition in Parliament. He moved the adoption of the report, confidently believing that the Committee had saved them from £80,000 to £90,000. Mr. R. Martin seconded the motion. In answer to Alderman Leeder, the Mayor stated that the report gave the Council power to carry on the appeal. Alderman Leeder then raised the question of how far the members of the Council would become personally liable to the costs of the appeal, and protested against any steps being taken until he had himself read and formed his own opinion on Mr. Justice North's judgment. The Mayor said the Committee had given notice of appeal against the judgment, and they had given the name of the Counsel (Mr. Cozens Hardy) whom they proposed to consult. The Committee, however, would not put the Council to any but necessary expense. He went on to say that the expenses of the proceedings taken by the Gas Company would far exceed those of the opposition in Parliament. The ratepayers would have to pay the former; the councillors themselves would be responsible for the parliamentary costs. A long discussion took place on some of the legal questions involved in Mr. Justice North's decision; and eventually the report was adopted by 12 votes to 7.

Capital of the Thorne Gas Company.—At a special meeting of the shareholders last Wednesday, a resolution of the Directors providing for the doubling of the nominal capital by the issue of 400 new shares of £5 each to the present holders, with the alternative of a cash bonus of £5, was adopted.

PARIS GAS COMPANY.

The Report and Accounts for the Year 1897.

The following is an abstract translation of the report of the Directors of the Paris Gas Company on the working of the undertaking in the twelve months ending Dec. 31 last, with the principal items in the accounts for this period.

The quantity of gas sent out last year for consumption in Paris and 59 neighbouring communes served by the Company was 315,308,270 cubic metres, or about 11,130,382,000 cubic feet; being 2,711,790 cubic metres, or about 95,728,000 cubic feet, less than in 1896, but higher by more than 3,000,000 cubic metres, or 105,900,000 cubic feet, than in any preceding year. About a million cubic metres of the difference may be accounted for by the fact that 1896 was a leap year; moreover, the succeeding year had not the benefit of the illuminations and unusually lavish display of lighting which took place on the occasion of the Franco-Russian *fêtes* in October, 1896, which caused a consumption of upwards of 800,000 cubic metres of gas. The remainder must be attributed to the exceptionally clear and comparatively warm weather which prevailed at the close of last year, and to the competition of electricity. The day consumption amounted to 99,899,850 cubic metres (3,526,465,000 cubic feet); being an increase of 2,932,380 cubic metres (103,513,000 cubic feet) on that of the previous year, and representing 31·68 per cent. of the total quantity of gas consumed. The continued increase in the consumption of day gas is, of course, attributable to its more extended use for culinary, heating, and industrial purposes. The receipts amounted last year to 80,162,526 frs. (£3,206,501); or 713,810 frs. (£28,552) less than in 1896. Of the total, 73,333,759 frs. came from the city, and 6,828,767 frs. from the surrounding districts. The number of consumers on Dec. 31 last was 371,567, compared with 347,295 on the corresponding day of 1896; being an increase of 24,272. In the last-named year and in 1895, there were 66,078 new customers placed upon the books; so that those added in 1897 make a total of 90,350—nearly one-fourth of the entire number—in the three years. This remarkable result is mainly attributable to the arrangement, introduced in 1894, whereby new consumers were relieved of the initial expenses of installation; and other beneficial measures, by which the number of services taken off the rising mains will be increased, and facilities afforded to consumers who may be changing their residences for a more speedy re-opening of their accounts in their new abodes, were brought into operation towards the close of last year. The number of burners in the public lamps on Dec. 31 was 95,988, of which 83,600 were employed in lighting the city, and 12,388 were in use in the suburbs. The total is an increase of 2944 in the twelve months covered by the report. At the crossings of the more frequented thoroughfares, and other places where extra light is required, recuperative burners are fitted up; and last year their number was increased by 424—bringing it up to 3922. The maintenance of the public lamps fitted with Welsbach burners has hitherto been placed by the Municipality in the hands of various contractors; but the Company were requested to undertake the work, and the Directors have agreed to do it for a year, by way of trial. They will thus be in a position to study a system of illumination which appears to them to present important advantages. The number of rising mains fixed at the close of last year was 45,000, as compared with 42,980 on Dec. 31, 1896; being an increase of 2020. There are no fewer than 34,913 houses provided with these mains, which are put in by the Company free of charge, so as to enable the occupants of apartments on the upper floors to procure a supply of gas as economically as those residing on the street level. The number of consumers on these mains at the end of 1896 was 216,585; at the corresponding time last year it was 238,896—an increase of 22,311, or at the rate of 9·34 per cent. These consumers represent more than 64 per cent.—nearly two-thirds—of the entire number. This is a very high proportion; and the augmentation of the day consumption of gas procured in this way has compensated to a considerable extent for the diminution resulting from the competition of other modes of lighting. The abolition of the charges for fitting, maintenance, and the use of services and meters, in the case of occupiers paying less than 500 frs. a year rent, has contributed largely to this result. The number of these small consumers on Dec. 31 last was 89,411, as compared with 71,830 at the close of 1896; being an increase of 17,581. Last year this class of consumers burnt more than 19 million cubic metres, or about 671 million cubic feet, of gas; producing a revenue of 5,700,000 frs. (£228,000). These customers now represent nearly a fourth of the entire number; and the Directors express their intention of not neglecting any opportunity of facilitating the use of gas by them during future years.

With regard to the works and plant, no change of any importance was made last year; the manufacturing appliances at the various stations being equal to the demands upon them. Necessarily, extensions of mains were required; and something like 23,216 yards of pipes were put down—14,985 yards in the city, and 8231 yards in the suburbs. This brought up the total to 2,668,858 yards, or more than 1500 miles.

There was a net sum of 4,955,805 frs. (£198,232) expended on capital account last year, as compared with 5,375,245 frs. (£215,010) in 1896, the larger portion of which was for rising mains, service-pipes, and meters. The capital account stood as follows on Dec. 31, 1897:—

	Francs.	Sterling.
Amount expended to Dec. 31, 1896	311,416,250	£12,456,650
Do. do. during 1897	4,955,805	198,232
Total	316,372,055	£12,654,882

To meet this there has been raised: By shares, 84,000,000 frs.; by bonds, 256,751,689 frs.—together, 340,751,689 frs. (£13,630,067). There is consequently a balance of 24,379,634 frs. (£975,185). The capital is represented by 336,000 shares and 553,332 bonds. Up to the date of the report, there had been redeemed 201,889 shares and 267,014 bonds; so that 134,111 shares and 286,318 bonds remain to be redeemed before the expiration of the concession in 1905.

The balance of the revenue account allowed of a further payment of 49 frs. 50 c. per share (£10); making in all 62 frs. per share, and leaving 283,921 frs. to be carried forward. The dividend is 3 frs. lower than that paid this time last year.

The following is the working account for the past year:—

Expenditure.

	Francs.	Sterling.
Value of gas in store on Jan. 1, 1897	69,953	£2,798
Manufacture of gas—		
Coals carbonized	20,543,330	821,733
Coke and tar for heating purposes	4,231,505	169,260
Salaries and wages	4,926,667	197,067
Maintenance of works and plant	1,627,938	65,118
Incidental expenses of carbonization	1,318,649	52,746
Purifying materials and labour	350,073	14,003
Distribution—		
Salaries of engineers and officers	2,550,201	102,008
Repairs, &c., of mains and services	1,534,008	61,360
Miscellaneous expenses, stamps, &c.	393,159	15,726
General management (including interest and sinking fund payments)	25,374,573	1,014,983
Pension and provident funds	1,847,659	73,906
Municipal charges—		
Tax of 2 c. per cub. met. of gas sold.	5,411,376	216,455
Rent of subsoil occupied by mains,&c.	200,000	8,000
Lighting, extinguishing, and maintenance of public lamps (less amount paid by Municipality)	1,337,373	53,495
State charges—		
Official gas testing, stamps, &c.	1,099,432	43,978
Total expenditure	72,815,896	£2,912,636

Revenue.

	Francs.	Sterling.
Value of gas in store on Dec. 31, 1897	58,955	£2,358
Sale of gas	80,162,526	3,206,501
Residual products—		
Coke	12,483,811	499,353
Tar	2,178,360	87,134
Ammoniacal liquor	859,379	34,375
Rental of meters and fittings on hire	2,493,529	99,741
Fire-bricks, &c.	41,072	1,643
Interest and discount	867,562	34,703
Total revenue	99,145,194	£3,965,808
Deduct expenditure	72,815,896	2,912,636
Balance, profit for 1896	26,329,298	£1,053,172
Add balance of 1896 liquidation	346,200	13,848
	26,675,498	£1,067,020
Deduct to meet outstanding claims	275,498	11,020
Balance available for distribution	26,400,000	£1,056,000
Deduct for share dividend	11,200,000	448,000
Balance, divisible equally between the Company and the Municipality	15,200,000	£608,000

The total amount available for distribution among the shareholders is, therefore, as follows:—

	Francs.	Sterling.
Dividend as above	11,200,000	£448,000
Half of divisible balance	7,600,000	304,000
Placed to shareholders' credit, as per resolution of March 23, 1875	50,000	2,000
Balance of undivided profits	245,509	9,820
Total	19,095,509	£763,820
Deduct 1 fr. per share for reserve fund	336,000	13,440
Balance	18,759,509	£750,380
Deduct interim dividend of 12 frs. 50 c. per share paid in October last	1,843,588	73,743
Balance available for final dividend	16,915,921	£676,637

Turning to the portion of the report dealing with the residuals, we find that the sale of coke in 1897 produced 253,141 frs. (£10,126) more than in 1896, owing to better prices being obtained. The receipts for tar and chemical products, on the other hand, were less by 283,967 frs. (£11,359); tar falling off to the extent of 146,858 frs., and ammoniacal liquor dropping 137,109 frs. This difference arose in the former case from the depreciation in the value of the bye-products of the distillation of tar, and in the latter from the increase in the manufacture of sulphate of ammonia in France and other countries. The Directors continue to bring under the notice of their agricultural *clientèle* the value of this material for their special purposes.

The Company's show-rooms are as productive of good results as ever. Last year they were visited by as many as 41,958 people, with the result that 1383 stoves of the Company's construction and 5920 by other makers were sold through these agencies. But the sales which are effected at the establishments of the makers themselves, as the result of visits paid to the Company's show-rooms, are much more considerable. For the production of motive force, 205 gas-engines, equal to 1180-horse power, were fitted up last year; bringing up the total to 2239, furnishing 8500-horse power. The gas consumed by these engines was 7,708,500 cubic metres, or rather more than 272,000,000 cubic feet. The consumption of gas for the production of motive power has not yet reached its limit; and therefore the Directors do not relax their efforts to develop this branch of the Company's business.

The report furnishes, as usual, full particulars in regard to the provident, pension, and other funds connected with the Company. Reference was made in last year's report to a sum of 600,000 frs. which was at the disposal of the Directors (300,000 frs. being contributed by the Municipality) for increasing the salaries, wages, &c., of the employees. They submitted to the Prefect of the Seine a scheme for the distribution of the above-named sum, accompanied by an explanatory note. The Committee of the Municipality to whom the matter was referred had a conference with the Directors, and suggested certain changes whereby a larger number of employees would benefit; and though this arrangement would entail a greater annual expenditure by the Company than the original scheme contemplated, the Directors had no hesitation in adopting it.

GAS AND ELECTRIC LIGHTING IN THE CITY OF LONDON.

The report of the Engineer to the late Commissioners of Sewers of the City of London (now the Public Health Department of the Corporation), on the works executed during the past year, has just been issued. It contains, as usual, particulars in regard to the lighting of the City streets by gas and electricity. The charge for gas is 2s. 3d. per 1000 cubic feet; and it comes to £2 8s. 4d. per annum for lamps burning 5 cubic feet per hour, £2 18s. for those burning 6 cubic feet, £4 16s. 9d. for 10-feet, £7 5s. 1d. for 15-feet, £9 13s. 6d. for 20-feet, and £24 3s. 9d. for 50-feet lamps. The number of defective gas lights observed during the year was 75. These returns are made daily by the police, and include only those lamps in which defective lighting is very noticeable. The number of gas-lamps now paid for by the City is 1896; more than one-third having been removed in consequence of the main thoroughfares being lighted by electric lamps. The 36 meters attached to the public lamps in various parts of the City show that the full contract quantity of gas is given at those lamps. The Inspector of Gas Lighting, as well as the Inspectors of Pavements, are of opinion that the full quantity is furnished generally throughout the City, and that the regulators of the lamps are kept in proper condition. Both the Gas Company and the Electric Lighting Company, acting upon general instructions in force for many years past, lighted the public lamps throughout the year whenever fog or unusual darkness ensued. This occurred on eight days. The experiment made in Wood Street by lighting that thoroughfare with the Welsbach incandescent gas-lamps has been in operation for over eighteen months; and Mr. Ross reports that the result has been satisfactory. The thoroughfare of Great St. Helens has been lighted on the same system; and the lighting of this locality has recently been added to by placing a lamp fitted with Denayrouze incandescent burners on a small rest formed on the open space at the entrance to the churchyard. The electric lighting of the main thoroughfares of the City by arc lamps was continued throughout the past year. The number of these lamps in use at the end of the year was 494. The question of lighting the side streets by electricity is still under consideration. The number of defective electric lamps observed during the year was 1620. These returns are made daily by the police; and the Electric Light Company are fined for failures.

BOLTON CORPORATION GAS AND WATER SUPPLY.

Extensions and Improvements.

As briefly recorded in the "JOURNAL" last week, an inquiry was held at the Bolton Town Hall, on the 15th inst., by Colonel J. T. MARSH, R.E., one of the Local Government Board Inspectors, in regard to an application on the part of the Corporation for sanction to borrow £100,000 for gas-works purposes, and £9000 for the improvement of the water-works gathering-ground. The first portion of the inquiry related to the amount required for the Water-Works Department.

The TOWN CLERK (Mr. R. G. Hinnell) explained that the Corporation purchased the water undertaking in 1847; and since then the works had been gradually extended. The last legislation with respect to the undertaking was the Confirmation Act of 1894, by which the Corporation were empowered to purchase or acquire by agreement such filter-land as might be required for the purpose of improving the supply. The Corporation had already bought 1785 acres within their gathering area on the Entwistle side; and provisional agreements had been entered into for the purchase of an additional 500 or 600 acres. The Corporation were enabled to borrow a sum not exceeding £100,000 for their water undertaking; and of this £65,303 had already been expended.

Mr. *R. H. Swindlehurst*, M.Inst.C.E., the Water-Works Engineer, explained a series of maps showing the watershed area.

There was no opposition to the application.

In regard to the application for sanction to borrow £100,000 for gas-works purposes,

The TOWN CLERK explained that the amount was made up as follows: For mains, £47,999; improvements at the Gas Street works, £16,517; at the Spa Fields station, £29,418; at Haulgh station, £350; and for the acquisition of a ground-rent, £3300—or a total of £100,584. For the information of the Inspector, he presented a brief history of the gas undertaking. It showed that the works were acquired in 1872, by the creation of perpetual annuities, which had now been changed into Corporation stock. There are two complete manufacturing stations—one at Gas Street, and the other at Lum Street—and the Corporation supply not only the borough but twenty neighbouring townships. Last year the make of gas was nearly 882 million cubic feet; while in 1882, when authority was obtained for borrowing £100,000, the make amounted to 519 million cubic feet. The whole of the £100,000 had been expended on improvements and extensions; and that it was warranted, was shown by the increased demand for gas. By the Act of 1882, the Corporation were authorized to borrow a further sum of £100,000, but subject to the sanction of the Local Government Board. This sanction was now sought. The income from the gas undertaking last year amounted to £135,269; and in 1883, when the price charged was 2d. more per 1000 cubic feet, it was £91,386. By their Act, the Corporation are empowered to charge for gas 4s. per 1000 cubic feet to consumers within a radius of two miles from the Town Hall, and 4s. 6d. beyond. The present price is 2s. 6d. and 3s. respectively. The profits made on the gas undertaking are sufficient not only to pay interest and provide for loan repayments, but to leave a very large sum each year to be applied in aid of the rates. Last year more than £20,000 was so handed over. They were not afraid of electricity. Although the electric lighting works, which were owned by the Corporation, had been in existence for nearly four years, there had been an increased demand for gas.

The INSPECTOR pointed out that with this further sum of £100,000 the Corporation would have exhausted their borrowing powers for gas-works purposes.

The TOWN CLERK said this was so; and if more money were required, they would have to get an amendment of the Act. He added that the period of repayment allowed by the last Act was sixty years; so that the Local Government Board need not concern themselves with this point.

Mr. *W. Smith*, the Gas Engineer, then explained in detail the character of the work proposed to be carried out. He stated that they were taking up most of the old mains, and replacing them with larger ones, so that they would get a greater pressure, which was badly wanted. There were also certain extensions of mains to supply districts adjoining the borough. It was explained that there were no outstanding loans in respect of any of the proposed work under the head of mains. As to the other items, at the Gas Street works, it was proposed to put down new plant, and enlarge the buildings, and also to erect a three-lift holder at the Spa Field station at a cost of £28,000. A sum of £3000 was required for a new retort-house at the Lum Street works; £350 for a governor-house at the Haulgh station; and £3300 for the purchase of a rent-charge on land at Burnden.

There was no opposition; and the inquiry closed. The next day the Inspector visited the watershed area, and also inspected the gas-works.

THE RAWSON PATENT IN AMERICA.

A recent number of the "American Gaslight Journal" contained the text of the decision of Judge Townsend, of the United States Circuit Court, Southern District of New York, in the action brought by the Welsbach Light Company against the Sunlight Incandescent Gas-Lamp Company for infringing their patent, by the use of collodion for stiffening mantles. It is as follows:—

The questions herein presented at final hearing on bill and answer relate to the first claim of patent No. 407,963, granted July 31, 1889, to Frederick Lawrence Rawson and William Stepney Rawson, for the "production of incandescent mantles," and assigned to the complainants. Prior to the discussion of the issue directly involved, it will be necessary to briefly describe the Welsbach light. In 1885, Dr. Carl Auer von Welsbach discovered or invented the mantle of the incandescent light which bears his name. Prior to that date, it was known that certain rare earths, when heated to incandescence, were possessed of great luminosity. Dr. Auer von Welsbach, or, as he will hereafter be called, Welsbach, was the first to discover that by immersing a textile fabric in a solution of the salts of the said rare earths, and afterwards applying heat and consuming the fabric, the earthy salts would be left in a coherent condition exactly reproducing the fabric consumed, and capable of emitting the intense white Welsbach incandescent light. Great as was this scientific discovery, it was commercially valueless. The resultant product was so light and fragile that although, as stated by the inventor, "it would remain effective as an illuminant for hundreds of hours," it would crumble to ashes if handled, or even touched by a hard body.

In their specification, the patentees, after speaking of the difficulty previously found in transporting these mantles without breakage, say: "This difficulty our invention is designed to overcome by dipping the mantles, after they have been given their proper shape, into a liquid which will thoroughly penetrate the pores of the material, and will afterwards set to such a degree of hardness as to protect the material from danger of breakage in packing or handling, and which can afterwards be removed without mechanical injury to the mantles or without leaving any objectionable residue."

The claim in suit is as follows: "The herein described improvement in strengthening incandescent mantles, consisting in coating the completed mantle with paraffin or other suitable material, substantially as set forth." The defences are invalidity for lack of invention, and denial of infringement.

Bright's British patent, No. 12,305, granted in 1848, for "improvements in lamps, wicks, and covers for vessels for holding oil and other fluids" *inter alia* describes a method of "manufacturing hollow cylindrical wicks in a stiffened state" to permit of their easy insertion into the lamp burner "by inserting them into paper cases . . . or by dipping them (not partially but wholly) in wax or in any other suitable stiffening matter." It has not the same purpose nor mode of operation as the patent in suit, and does not anticipate it.

Gwynn's patent, No. 52,788, issued in 1866, for an "improved process for saturating wood, cloth, paper, &c., with paraffin," and Toppan's patent, No. 89,095, for "improved water-repellent material," may be considered together. The patentee Gwynn says that "when the paraffin is thus combined with the substances, they seem together to form a new substance, inasmuch as it cannot be again expelled," and that substances thus saturated acquire "greatly increased tenacity, toughness, power of endurance, and of resistance to the action of the elements." Toppan described a similar treatment with a solution of paraffin. Each of these patents describes a process for making wood, paper, and cloth waterproof, by permanently combining them with paraffin. Neither of them attempts to effect the object of the Rawson patent.

But the defendants rely chiefly upon patent No. 261,529, issued July 25, 1882, to Charles Clamond, for "means and apparatus for producing intense white light." Fig. 9 of the drawings shows a burner composed of magnesian threads. These threads are made by forcing a wet plastic material through dies. While thus wet, they are shaped into the form of a cone, which is then dried and baked. The resultant product is a fragile, porcelain-like shell or basket, of refractory material, capable of use with a gas-burner to produce an incandescent light. In connection with this basket, the patentee used small rods formed of the same material. It was not claimed that there was anything novel in Clamond's magnesium light which is relevant herein; but defendants contend that "this patent shows that the strengthening of such fragile, refractory cones, to protect them against breakage in transport and handling, was not new." This contention is founded upon the following statement in Clamond's specification: "The basket may be cased over with paper or other combustible material, so as to strengthen it for transport and handling; this casing being burned away when the jet is ignited."

In this chief reliance of the defendants I find nothing to detract from the merit of the patented invention. There was no strengthening treatment of a refractory material having the form of a textile fabric, no combination with another substance by saturation in a protecting solution, and no process of hardening the protecting solution. In short, Clamond merely proposed to wrap up his porcelain cone in a piece of paper which would burn off when the cone was placed over a lighted flame. He protected his shell by an ordinary external wrapper, which

could be removed in the ordinary way, leaving the shell as before. By the Rawson process, the solution so penetrated the interstices of the Welsbach fabric that it became an integral part thereof.

But the expert and Counsel for the defendants claim that "all the Rawsons have done is to apply the old Gwynn process of dipping porous articles in hot, melted paraffin, or the Toppan process of dipping porous articles in paraffin solutions with a volatile hydrocarbon, such as benzine or naphtha, without any difference in their mode of application, or the result obtained therefrom, to the old purpose of protecting fragile mineral cones in transport and handling, set forth by Clamond." I cannot assent to this proposition. The Clamond protecting wrapper is not even remotely allied to the Rawson strengthening process. The result of the latter is new, distinct, and strikingly unexpected. To introduce these processes in this new art, and to work out and apply the undeveloped possibilities of this use of paraffin in solution in connection with these earths, so as to place this light within the reach of the general public, was a most meritorious invention. Defendants say it does not infringe because it does not coat the mantles with paraffin or any of the equivalents mentioned in complainants' patent, and they rely upon certain limitations claimed to be disclosed by the file wrapper.

After describing the use of paraffin in the specification, it is there set forth that "other materials may be employed as long as they set hard at ordinary temperatures and burn away without mechanical destruction to the mantle, and without leaving any residue which would injure the light-giving properties of the mantle." The examiner required the patentee to insert a specific statement as to what other materials are used; and the following was thereupon added: "The materials referred to as being capable of use in lieu of paraffin may be any solid hydrocarbon of a high boiling-point, and many resins and gums soluble in spirit, such as alcohol, &c. Shellac will serve the same purpose, but not quite as advantageously."

The defendants insist that the patent cannot be infringed by the use of any materials other than those thus specified. "It is admitted 'that the defendant Corporation herein has been . . . and still is, coating completed incandescent mantles or hoods, for the purpose of strengthening them for transport and handling, by dipping or immersing them in a solution composed chiefly of collodion, with the addition of a small percentage of castor oil, and in excess of 5 per cent.' That such solution is a liquid which, after the mantle or hood is coated therewith, by dipping or immersing the said hood in such solution, will afterwards set at ordinary temperatures to such a degree of hardness as to strengthen the mantle or hood for the purpose of preventing breakage in transport and handling, and of such a character that it can afterwards be removed by burning away without mechanical destruction to the mantle, and without leaving any residue which would injure the light-giving properties of the mantle or hood." The complainants contend that this collodion solution is included under the words "paraffin, or other suitable material, substantially as set forth," in the first claim, notwithstanding the enumeration of equivalents in the patent.

The invention of the patent in suit transformed the Welsbach mantle from a laboratory experiment into an article of commerce. That it has successfully overcome the obstacles previously encountered, and has accomplished results quite as important as the original Welsbach invention, is admitted. The evidence as to Welsbach's understanding of the limitations upon the practical use of his light, and the graphic illustration at the hearing herein of the bold and unique treatment of the fragile mantle, and the success of the adaptations employed in producing the desired results, indicate not only the presence of inventive genius, but claim for the invention the rank of a pioneer. For these reasons this patent should not be narrowly interpreted, but should be so construed as to cover a broad range of equivalents. The undisputed testimony of Dr. Chandler and President Morton shows that it was well known, at the date of this invention, that such a collodion solution would operate in the same way as a paraffin or shellac solution in the treatment of such substances, and was therefore an "other suitable material." That in every other respect the defendants have appropriated the patented process, appears from the admission. While collodion is not chemically an equivalent of a hydrocarbon resin gum, and is not paraffin or shellac, it performs the same functions in the same manner and with the same result. A patentee is not obliged, in his specification, to state all the known equivalents of the materials used by him. It is the patent as finally issued which the Court is to construe, and upon which the patentee must stand. In this case, the patentees have claimed "paraffin or other suitable material, substantially as set forth." They have set forth that "other materials may be employed as long as they set hard at ordinary temperatures, and burn away without mechanical destruction to the mantle." The defendants use a suitable material known at the date of the invention to have all these properties and characteristics, and have thereby appropriated complainants' product. Let a decree be entered for an injunction, and an accounting.

Shutting off Gas at Fires.—The Gas Committee of the West Bromwich Corporation have been considering the present inadequate means in the borough for stopping the gas supply in case of fire occurring in factories, warehouses, and the larger shops and residences; and they are of opinion that some provision should be made for promptly shutting off the gas in the contingency referred to. They have therefore given instructions for shut-off valves to be fixed in a readily accessible position in the footpaths in all gas-services from 1¼ inches diameter upwards; and the work will be proceeded with as fast as possible.

Inclined Retorts at the Batley Gas-Works.—Last Thursday afternoon, on the invitation of the Chairman of the Gas Committee (Alderman John Blackburn), the members of the Batley Corporation paid their first official visit to the recently reconstructed gas-works. The inclined retort system has been adopted, at a cost of close upon £10,000; and the supply is sufficient for the maximum requirements of the town, while the old plant can be pressed into service as the town extends. The productive capacity of the new retorts, as at present worked, is 300,000 cubic feet per day. The inspection was carried out under the guidance of Mr. J. F. Bromley, the Engineer and Manager, under whose superintendence the whole work has been conducted; and what was seen gave the greatest satisfaction. Afterwards Alderman Blackburn entertained his fellow-members and the officers of the Corporation at the Town Hall.

ELECTRIC LIGHTING NOTES.

At a special meeting of the Oldbury District Council last Wednesday, the Clerk (Mr. W. Shakespeare) explained that at the last meeting (*ante*, p. 844) he was instructed to try and arrange terms with the Midland Corporation for supplying Oldbury with electricity. The terms were that the Council should obtain an Order from the Board of Trade for supplying electric light for all public and private purposes, and that the Midland Corporation should also obtain one to supply the manufacturers. The Corporation had agreed to drop their application altogether, leaving the Council free to obtain their Order for all purposes. Mr. Beach, in moving that these terms be accepted, said the Council were now in the position they desired at first. The motion was carried.

A statement prepared by Mr. W. H. Trentham, the Consulting Engineer, shows that the capital expenditure on the Torquay Corporation electric light undertaking to Feb. 26 last was £23,483. The estimate was £23,716; so that the work has been carried out well within the sum contemplated. There has, however, been a considerable departure from the original estimate. A change in the position of the engine-house involved an extra outlay of £750; and other items of expenditure, including superheaters, automatic switches, and a weigh-bridge, not included in the estimate, cost £575. On the other hand, the laying of the mains in part of the area of supply remains to be undertaken at an estimated outlay of £865. A comparison of the figures shows that the boilers were estimated to cost £2127, and the expenditure was £2766; the engines, £8517 estimated, £8939 expended; the arc lamps and posts, £1320 estimated, £1434 expended; the mains, transformer, and street work, £7689 estimated, £6767 expended; the chimney, converting buildings, &c., £1351 estimated, £1840 expended; consumers' connections and meters, £1573 estimated, £560 expended. Mr. Trentham defends the change of site on the ground that the generating station is much roomier than it would have been under the original arrangement, besides which there can be added "machinery to deal with lights bringing in another £4500 per annum" without further outlay on buildings.

A formal beginning of the work of erecting the Plymouth electric light station was made on Thursday, when the Mayor (Alderman J. T. Bond) laid the foundation stone of the building. All the contracts were let some months ago; and already a good deal of progress has been made, so that it was possible for Mr. A. R. Debnam, the Chairman of the Electric Lighting Committee, to talk of the possibilities of the light being installed by next winter. One distinction claimed for the Plymouth installation is that it is the first in the United Kingdom which has been started for the dual purpose of lighting and providing motive power for the tramways. The Plymouth Corporation own and work tramways in the borough; and in carrying out the electric light scheme, they have provided for the working of the cars on one of the two main routes by electricity. In the building now in course of erection, provision is made for the supply of about 10,000 lamps of 8-candle power, and there are to be 21 miles of cables, while 74 arc lamps will be erected in the principal streets and on the Hoe. The site of the works is on the north shores of the Cattewater, with railway and water facilities, and abundant room for extension. Mr. Debnam spoke of the great improvement which is to be effected in the lighting of the streets, and said that in place of gas-lamps having a lighting power of 5000 candles, they would have electric lamps giving that of 100,000 candles. The difference in cost would not be so great as might at first appear, and they were to get nine times the amount of light. Commenting upon this statement, the "Western Morning News" points out that the estimate of Mr. J. H. Rider, the Electrical Engineer, is that the arc lamps will cost £1184 per annum, as against £475 now paid for gas, and says it remains to be seen whether there is a corresponding difference in lighting effect. The Mayor's speech was one of congratulation. The Corporation, he said, believed that necessaries of every-day life which were required for common use and were participated in by the whole of the people should be owned by the people themselves. Already they had the water property and the tramway undertaking, and they wanted better and purer light and plenty of it; and the Legislature had wisely given municipalities the opportunity of providing it.

At the meeting of the Manchester City Council last Wednesday, permission was given to Mr. Alderman Higginbottom to introduce, out of the ordinary course, the recommendation of the Electricity Committee to make application to the Local Government Board for their sanction to the borrowing of a further sum of £150,000 for the purposes of the electricity undertaking of the Corporation. In moving the adoption of a resolution approving the Committee's recommendation, Alderman Higginbottom said the money was required for electricity purposes in the city, Moss Side, Levenshulme, and Withington, under Orders which had been sanctioned by Parliament. In Manchester it was needed to provide, first, six new feeders to supply the old network, which would be necessary to convey the current from the new generators to the mains; and, secondly, distributing mains in Chester Road and City Road. These mains it had already been determined by the Committee to lay forthwith. Borrowing powers would also be required for the erection of cable stores and a testing-room on the land at the Polygon, and for purchasing sites for transformer sub-stations in various parts of the City. The high-pressure feeders would be necessary for supplying some of these sub-stations, and also the sub-stations in Moss Side and Levenshulme. Provision was also made for carrying out the street lighting which it had been decided to provide for winter. There had likewise been included a sum for new services and meters in the City area. In regard to Moss Side, the money was required for the distributing mains in the compulsory streets, and for the high-pressure mains; at Levenshulme, for a site for a transformer sub-station, for distributing mains in the compulsory streets, and for high-pressure feeders; at Withington, for sites for transformer sub-stations, for distributing mains in the compulsory streets, and for high-pressure feeders. The following was a summary of the estimated cost: Manchester, £73,300; Moss Side, £15,600; Levenshulme, £8970; Withington, £48,920—total, £146,790. This would leave a sum of £3210 for sundries and contingencies. Mr. J. Phythian, the Deputy-Chairman of the Electricity Committee, seconded the motion. Sir John Harwood suggested that the sum asked for should be £200,000; and he moved an amendment accordingly. It was seconded by Mr. W. Pollitt, and agreed to.

METROPOLITAN WATER SUPPLY COMMISSION.

Eighteenth Day—Monday, April 18.

(*Viscount* LLANDAFF, *Chairman, Sir* GEORGE B. BRUCE, M.Inst.C.E., *Major-General* A. DE COURCY SCOTT, R.E., *Mr.* A. DE BOCK PORTER, C.B., *Mr.* H. W. CRIPPS, Q.C., *and Mr.* R. LEWIS.)

The sitting took place at the Westminster Town Hall.

The following Counsel are engaged: Mr. POPE, Q.C., and Mr. CLAUDE BAGGALLAY, Q.C., for the New River Company; Mr. LITTLER, Q.C., and Mr. LEWIS COWARD for the Kent Water Company; Mr. PEMBER, Q.C., for the Lambeth, East London, Grand Junction, and West Middlesex Water Companies; Mr. RICKARDS for the Chelsea Water Company; Lord R. CECIL for the Hertfordshire County Council; Sir JOSEPH LEESE, Q.C., M.P., for the Kent County Council and Kent Local Authorities; Mr. BALFOUR BROWNE, Q.C., and Mr. FREEMAN, Q.C., for the London County Council; Sir R. NICHOLSON for the Middlesex County Council; and Mr. GABRIEL P. GOLDNEY (Remembrancer) for the Corporation of the City of London. The Southwark and Vauxhall Water Company are represented by Messrs. BIRCHAM AND CO.

Mr. *G. P. Goldney*, Remembrancer of the City of London, who was under examination when the Commission last adjourned, was further questioned by the CHAIRMAN. Asked to give an instance in the City in which the payment for water agreed between the New River Company and the occupier had been raised on account of an increase in ratable value, he referred to a bank that was rebuilt four years ago. Its ratable value was now £5167; and by agreement with the New River Company, the annual payment for water was fixed at £97 16s. including everything. On ratable value alone—which was 3 per cent. at that rental—and disregarding closets and high services, the Company would be entitled to charge £155; so that there was a reduction of at least £58, or over one-third on what they might charge. He had been unable to ascertain the charge before the rebuilding. It being pointed out to witness that this was not a case where the charge had been raised, he said he knew of no instance where the Company raised the charge simply because of an increase of ratable value.

Mr. DE BOCK PORTER: Is there any scale which determines the amount of these charges?

Witness: There is no scale, as far as I can ascertain, that is known to the consumer. It is a matter of negotiation in each case between the consumer and the Company, though I believe the Company are guided by certain general principles. There is no fixed abatement; each case is considered on its merits.

Have you any evidence of these modified charges remaining (say) for 20 years undisturbed?—No; I have no case of that kind.

The CHAIRMAN: You could not say how much the City of London actually pay the New River Company now?

Witness: No.

You cannot tell us how much the City is saving by these arrangements?—I could not.

I understand that in your view, if purchase took place, the City would lose the benefits of these abatements?—Yes.

And its rating would have to go up to the common level, whatever that was?—Certainly.

You cannot give us any idea what the figure would mean in the City of London?—I do not think I can give you a figure that should be put on the notes. I have been trying for many years to ascertain it; but I do not think I can name a figure which I should be justified in quoting in evidence.

If purchase was effected, as Mr. Gomme rather suggested, there might have to be some public municipal rate in aid of the water fund; and you would anticipate also that this would fall upon the City?—Yes.

Not only would your charges for water be raised up to the common level, but you would have to pay a municipal rate besides?—That would be so. The City already pays considerable sums for the benefit of others, from which it derives no real benefit itself—for the School Board, the Metropolitan Common Poor Fund, the Equalization of Rates, &c. Supposing that the charge of the West Middlesex Company was generally adopted over London, and a public rate were necessary to make up the deficiency, I cannot see how the West Middlesex consumers could escape having to contribute.

Is the conclusion you draw that a system of purchase would be disadvantageous, at any rate for highly rated districts?—Yes, from the financial point of view, to all that portion of London; and outside, too, where the ratable value is comparatively high, and the population comparatively low. The basis of future charge is, from the City point of view, one of the most important elements in considering the whole question; but the City is strongly in favour of dealing with the Water Companies so that they should not be conducted entirely as mercantile concerns. There is a very general feeling in the City that the treatment by the New River Company of the City ratepayers, *qua* City ratepayers, is very fair and reasonable, having regard to the power their Acts of Parliament give them.

Witness, in answer to further questions, said he thought the City would approve of some such system as that at Birmingham, where a modified charge was made for premises and shops having no residential population—assuming it could be carried out. He did not believe there were actually any agreements with the New River Company. The City had contemplated negotiating for the purchase of the New River Company, but not since witness had been Remembrancer. Asked why these negotiations failed, he said there was perhaps a little personal element in the matter.

By Major-Gen. SCOTT: The City was keeping an open mind as to whether there should be purchase or public control. The position was this—that subject to the City being sufficiently represented by the purchasing and managing body, and to the price not being exorbitant, they would prefer purchase; but if the price was not what they considered right, or the representation inadequate, they would prefer control. He did not think the City wanted any particular sort of arbitration; they could not hope for the special terms suggested by the London County Council. The City would favour purchase at a price which would not impose upon them an extra charge.

The CHAIRMAN: Is the City of opinion that a perfectly open arbitration, in which the arbitrator would have full power to award what he thought fair, would have that result?

Witness: Yes—of charging the City more.

Then, financially speaking, is the City against this sort of open arbitration?—It is against purchase on such terms.

Witness (continuing) suggested that if the Companies were allowed to go on for a few years, owing to their obligations in the way of capital expenditure without corresponding return, their value would be much reduced; and thus purchase could be effected at a much lower figure than would now have to be paid. Proceeding, he laid before the Commission a suggestion as to how control could be exercised, and the general effect of it. In the first instance, the Companies should be grouped. Drawing a line roughly from north to south of London, on the west would be the Companies depending on the Thames for their supply, and on the east the Companies that he would call "Non-Thames." Then the river bisected that line. In this way, the groups would be West Middlesex, Chelsea, and Grand Junction (a Thames group); New River and East London (chalk group); Lambeth and Southwark (a Thames group); and the Kent Company by itself (chalk group). He had taken out areas, the number of houses, ratable value, average daily supply, &c., of each of these districts; and it was remarkable how nearly the area was divided, half and half, between chalk and non-Thames, and what a strong approximation there was with regard to rateable value and population between the two divisions. The advantage of this grouping would, first, be in the exercise of much more effectual control, by having a Board of Control, say, of 48 members, elected from each district, upon the basis of population and rateable value. Neither population nor rateable value by itself would, perhaps, be quite fair as a basis of election; and therefore he would endeavour to combine the two. The Boards would have to be created by Act of Parliament in the first instance; and they would have power to levy a rate on the basis of the county rate, both inside and outside the Metropolis. The existing Companies would at first go on as now. The Board would have power to deal with all matters of efficiency and sufficiency of storage capacity—to direct the Company to provide more storage. At this stage, witness was subjected to a great number of questions as to the exact consideration that had been given to the scheme he was outlining by the Corporation as a whole, and by the Committee to which the matter had been referred. He said the scheme had been considered by the Committee to which had been entrusted the reference to the Commission; but it had not been dealt with in detail by the Corporation. The Committee thought the scheme was worthy of investigation—that it was a desirable one to adopt—but they were not prepared to say that it was the only solution of the question. Witness went on to remark that other powers that would be delegated to the Board would be with regard to ensuring the purity of the water and the supply of the same at sufficient pressures, for which purpose, if necessary, a separate Water Examiner should be appointed for each area. All powers of the Official Auditor, and power of appeal to the Railway Commissioners, under the present Acts, to decide questions in dispute between them and the Companies, would remain.

The CHAIRMAN: You would transfer to this Board of Control the statutory powers vested in the London County Council and the Local Authorities under the Act of 1897?

Witness: Yes.

Mr. DE BOCK PORTER: With power to revise rates?

Witness: That is not suggested at the present moment. In each group the charge would have to be brought to a level.

The Statute creating the Board of Control should vest in them the power to alter the charges of the Companies if they think right?—Yes.

Sir G. BRUCE: They would be likely to reduce the rates to nothing, would they not?

Witness: They would have to get it out of some other rate then.

By the CHAIRMAN: The Statute creating the Boards would fix the rates to be charged.

The CHAIRMAN: What is to be the consideration to the Water Companies for this?

Witness: What is to be the consideration to the Water Companies for any form of control?

What consideration is to be given to the grouped Companies for manipulating their charges in this summary fashion?—That is the difficulty underlying the whole question of control; and I cannot answer it. If you treat the Companies simply as mercantile undertakings, any form of control would be an injustice, without a *quid pro quo*. The Committee of the Corporation have not considered whether it would be unjust to cut down the charges. Under the scheme, the Companies in each group would be amalgamated, so that if a fresh supply were needed they should go for it together. With regard to the powers of the Auditor, the suggestion is that they should be wider than at present. The near approach of the time when the Companies will be paying the 10 per cent. maximum dividends, renders this question of the Auditor's powers of much greater importance than formerly. Complaints are made that the Auditor has not sufficient power in allocating the income of the Companies between capital and revenue accounts.

Mr. LEWIS: In what respect?

Witness: I cannot answer that in detail. I can only reply in a general way. The particular point I want to emphasize is that, instead of control being exercised over the whole area, it should be applied in smaller sections; because in this way we should have a more thorough local knowledge, and it would be brought home to the people that they had an effective control.

The pith of your suggestion is that control should be vested, not in the persons who have control now—the Water Examiner, the Auditor, and the Local Authorities—but in these four Boards?—Yes; concentrated powers.

Would you pay the members?—No.

Witness (continuing) said appeal from the decision of the Board of Control would be to the Railway Commissioners or to Parliament. The County Councils of the various districts would not exercise as efficient control as the Boards proposed, because each Company was in the district of at least two Councils. The Boards would have authority only in the areas of actual supply of the groups of the Companies, so that practically there would be no overlapping. Passing on, he gave evidence regarding the sinking fund, the main object of which was to stereotype the value of the undertakings at the date of the several sinking-fund

lauses, and to save, therefore, any possible purchaser a number of years' purchase of what the fund amounted to. At present, the sum subject to the sinking-fund clauses was £6,320,000. The annual instalment paid last year was £4804; but in 1915 it would be £120,000. When the City Chamberlain received these instalments, he had hitherto been obliged to go into the market and buy stock of the particular Company from which the instalments had accrued. The purchases had only numbered four or five altogether; but he could not give the details of them. The Chamberlain anticipated difficulty, by reason of having to invest in the stock of the Company furnishing the instalment; and in 1896 an attempt was made to effect an alteration so that he could invest in the securities of any one of the eight Companies. There was no advantage to the Chamberlain in investing in the securities of a particular Company.

Mr. POPE remarked that the Companies disliked this provision as much as the Corporation did.

Witness said the Chamberlain was investing the interest as it was received, and in this way was creating a market against himself. The pinch, however, had not yet come, because the transactions thus far had been so small.

By Mr. BALFOUR BROWNE: The primary object of the sinking fund was not to create a fund, but to lessen the cost of purchase.

Mr. BALFOUR BROWNE: And there would be no meaning at all in the sinking fund, unless purchase had been completed?

Witness: Purchase at the time when the sinking-fund clause was first enacted was contemplated.

And ever since, because there has not been a single Act passed which did not include the sinking-fund clause?—That is so. The City Corporation held an inquiry in 1890; the conclusions then arrived at being in favour of purchase.

Up to 1896, the Corporation were in favour of purchase, subject to certain reservations?—Yes.

As I understand, your objection to purchase to-day is that you think too much may have to be paid for the legal purchase?

The CHAIRMAN: That is one objection.

Mr. BALFOUR BROWNE: I do not know any other. (To witness:) If you can be assured that the Companies can be purchased at an amount which would not put anything on the ratepayers of the City of London, would you then be in favour of purchase?

Witness: If the Corporation can be reasonably assured that the Water Companies can be purchased at such a price as would justify the purchasing authority in charging no more in the City than is charged at present, the City would certainly adhere to the policy of purchase.

The CHAIRMAN: Can you be sure of that?

Mr. BALFOUR BROWNE: It seems you want to see the award of the arbitrator beforehand.

Witness: I said "reasonably assured." The City object to purchase, because they are not reasonably satisfied—that is their difficulty.

Would you tell me why they were reasonably satisfied from 1886 down to 1897, when they assented to a Purchase Bill; and why they are not satisfied now—because the bargain was the same all the way through between you and the Water Companies?—I do not think that anybody had the amount of information on the subject that is existent now.

Why did they think that purchase was good in 1896, and bad in 1898?—In 1896 they were undoubtedly prepared to join in the purchase, if they could be reasonably satisfied that they were to have a representation on the purchasing as well as the governing body, and that the basis of future charge was to be satisfactorily dealt with.

The CHAIRMAN: Did you receive any assurances from the representatives of the London County Council that these subjects should be achieved?

Witness: We did.

Mr. BALFOUR BROWNE: Supposing you are still assured that you are to have one-eighth of the representation on the Statutory Committee, and that nothing in a Purchase Bill will prejudice a re-consideration of the basis of rating, will you be satisfied?

Witness: No; not with "a re-consideration of the basis." I do not know that I am in a position to answer that, because a good deal has happened since 1896. The value of the undertakings has gone up enormously since that year.

In further cross-examination, witness denied that he based his objection to purchase on behalf of the City on the statement of Mr. Dickinson, in his Memorandum, that purchase at £30,000,000 would raise the cost of water to the consumers 30 per cent. The fear and objection of the City was not to the undertakings going into the hands of a public authority, but that it would cost so large a sum of money. Their circumstances were such that, if an increase took place, it might be very large in the City. His calculation of £48,000,000 as the purchase price of £1,200,000, was on the basis that the latter amount would have to be purchased. He knew that the sum comprised the interest and dividends which the Companies paid; but he did not know that the proposal was that the debts should be taken over, leaving only the dividends—amounting to £928,721, not £1,200,000—to be purchased. This would mean multiplying the sum by 40; and he knew that the highest number of years' purchase ever allowed for a water concern was slightly over 30.

Mr. BALFOUR BROWNE: Are you aware that if we purchase this £930,000, raising our stock at 2½ per cent. and paying 30 years' purchase, we should have, without increasing the rates one penny, enough to pay the whole interest upon the purchase-money at 30 years' purchase and the sinking fund besides?

Witness: It reads rather like a prospectus.

It is a difficult thing to go into these calculations now; but if that was the maintainable income, my calculation would be sound. If that is not the maintainable income, a smaller sum would have to be given?—I think the purchase-money would be calculated upon the present and prospective income of the Company, fixed at a certain number of years' purchase. You have, however, ignored the loss arising from the levelling of the charges—which, in the City, would mean a levelling up—and some other items of a similar nature. With regard to the proposed system of control and the rate the Boards are to levy, this rate would be infinitesimal, and would be raised by issuing a precept to each county concerned.

Then the Board are to see to the efficiency of the storage. Suppose they go to one Company, and say: "Your storage is not sufficient." Do you give them a right to apply for a Bill for further storage?—No. The Board would go to the Company; and if the Company disagreed, they would go—at all events, at present—to the Railway Commissioners.

Do you really propose to give a judicial body like the Railway Commissioners power to order a trading Company, whether they pay or not, to provide more storage?—I propose that they should have a discretion. They would make a finding or award; and upon this the Companies would undoubtedly obtain further powers.

The Board complain that a certain Company have not got sufficient storage. The Company say: "We have." The Board take proceedings before the Railway Commissioners. The Railway Commissioners decide that the Company have not sufficient storage. The Company snap their fingers at the Railway Commissioners. Who is to promote a Bill in Parliament to force them? If the Companies were so unwise as not to do it themselves, I should think any public authority or board, or any county council, would be justified in going for a Bill for the purpose.

Therefore you go back, failing control, to purchase?—I did not say that. I said, failing a Company going for a Bill, the Board of Control or one of the Local Authorities might easily promote a Bill to do the work and charge the Company—any way you like.

Would you allow the Company to oppose the Bill?—The Company would have the right.

Then what is the use of going to the Railway Commissioners?—If there were a recognized body of experts, as these Railway Commissioners are, not one of the Companies would fail to abide by their decision.

The Commission then adjourned till yesterday, the 25th inst.

The nineteenth sitting of the Commission was held yesterday, at the Westminster Town Hall—Lord Llandaff presiding. Mr. Goldney handed to the Chairman a table specifying the various investments made by the City Chamberlain of the instalments paid to him by the Companies who come under the operation of the sinking-fund clauses. From this, it appeared that about £9000 of stock had been purchased, at a cost of a little more than £22,000. The witness was then cross-examined by Mr. Baggallay on a number of the points on which he had given evidence.

PLYMOUTH CORPORATION WATER SUPPLY.

The Progress of the Burrator Reservoir.

Good progress is being made with the great reservoir which is being constructed at Burrator, on Dartmoor, for the supply of Plymouth with water. The work has been designed by Mr. J. Mansergh, M.Inst.C.E.; and it is being carried out by Mr. E. Sandeman, Assoc.M.Inst.C.E., the Water Engineer of the Plymouth Corporation. The combined efforts of these gentlemen will result in the creation, on the fringe of the moor, of what will be practically an artificial lake. Some idea of the size of the sheet of water to be impounded may be gathered from the statement that the reservoir will be 1½ miles long by half-a-mile broad, and contain no less than 650 million gallons. At its greatest depth the water will be 77 feet deep; and a large tract of cultivated land, together with one or two farmhouses, will be covered. According to some particulars of this important work which appeared a few days since in a local paper, the chief feature in the undertaking, from an engineering point of view, is the masonry dam which crosses the valley at Burrator. When completed, it will be 363 feet long at the water-level. At the deepest point of its base it is 77 feet thick; but the average thickness at the river bed is 62½ feet. From there it narrows to a width of 21 feet at the top. Above the dam proper will be a roadway carried over the centre of the structure by five arches, each with a 25-feet span. Between these arches the overflow water will pass out over the dam when the reservoir is full. At the sides, the roadway, which will be 18 feet wide and 11 feet above the top of the dam, will be supported by a wall of concrete. In excavating for the foundations, it was found necessary to go down 53 feet below the bed of the river; and the height of the massive structure from the lowest point excavated to the top of the roadway will be 129 feet. No less than 29,000 cubic yards of material were taken out in the course of the excavation. All the fissures in the granite on both sides of the valley and below the river bed have been cut out by hand labour; no explosive being used in the excavations in order to avoid creating any further cracks and crevices in the rock. The process was necessarily slow and tedious; but the Engineers and Water Committee of the Corporation have the satisfaction of knowing that the dam rests on a solid bed of rock, without, so far as human skill can detect, a crevice or crack—a satisfaction which will, of course, be shared by the town at large.

The face and top of the dam have been constructed of uncoursed ashlar, consisting of square blocks of granite; and the core of the structure is composed of "cyclopean rubble," consisting of large masses of granite embedded in concrete. On the side of the dam which has to resist the water pressure, the granite blocks have been rabbeted to a depth of 6 inches; leaving a space ⅜ inch wide to that depth between each of the blocks. These spaces have been filled in with neat cement, slightly damped, and driven in by an iron chisel. By this process an exceedingly hard and water-tight joint has been obtained, so as to make the face of the dam absolutely impervious, and prevent water percolating into the core. For a considerable portion of its length, especially in the centre, the dam itself is now complete. The piers, which will support the arches of the roadway, are also finished; and the construction of the arches themselves has been commenced. At the sides, the masonry support for the roadway has been carried above the top of the dam proper to within 8 feet of the level of the intended road.

In the early stages of the construction of the dam, the River Meavy was diverted from its old bed and carried temporarily over the site by means of a lander. Later, as the work progressed, a tunnel 10 feet in diameter was made through the dam on a level with the old river bed. Through this tunnel the river now flows; and it is intended shortly to lay two pipes for the purpose of conveying water to the line of pipes now running from Burrator to Roborough. When these are in position, and the moment for impounding the river arrives, the tunnel will be permanently closed by an iron shield placed over the entrance, and the interior filled up with concrete. There is also a steel pipe 30 inches in diameter through the dam at a higher level. At present its purpose is to feed the leat; but it will form eventually a supplementary means of feeding the

pipes supplying the town. Running longitudinally through the dam is a second tunnel 6 feet high and 2 feet wide, through which, after the works are completed, one may walk and inspect the interior of the structure. Besides putting the finishing touches to the top of the dam itself, and the erection of the superstructure with its five arches carrying the roadway above, all that remains to be done at the dam is the fixing of the machinery for working the valves, the construction of screen chambers, and other subsidiary works on the lower side of the structure. Farther up the valley, near the village of Sheepstor, a secondary dam, which is intended to prevent the overflow of the reservoir at a point where the land dips a little, has been formed. It is expected that the reservoir will be completed by the middle of September.

NOTES FROM SCOTLAND.

From Our Own Correspondent.

Saturday.

Owners of gas-works who have not been able to close their contracts for the supply of coal for next year, would seem to be left in the lurch. On account of the Welsh dispute, the price of coal has been advanced about 3s. per ton. Such a rise is, of course, not expected to be permanent; and so nobody would think of entering into a contract for a year upon these terms. That being so, those who are in process of contracting are holding over the offers they have obtained, in the hope of more favourable times arriving. This has been done by the Gas Committee of the Corporation of Aberdeen. They have coal which will carry them over in the meantime. In Dundee, the Gas Committee have remitted the tenders for coal to a Sub-Committee, which is a form of delay; but they also seem disposed to carry through the contract, although the tenders are higher than they were last year. In some places there is a strong objection to the gas manager having large stocks on hand at the close of the financial year; and if this be the view of the Dundee Corporation (their year ending on the 30th inst.), the stock of coal would be at present so low that they will be at the mercy of the coal merchants. The situation which has arisen shows how unwise it is on the part of Corporations to interfere with what is the proper function of the gas manager, or to curtail his liberty. He is the official who is responsible; and I would certainly urge, on his behalf, as I did last week, for the most perfect freedom to attend markets and exchanges, in order that he might keep himself in touch with current commercial affairs. I do not speak of Dundee; but I know of a place where the manager is not allowed to leave the town without permission having been asked and accorded. While it is advisable that a manager should always leave, at his own home, an address where he could be found, in case of emergency, it is ridiculous that he should be treated like a schoolboy in the matter of leave. It is more than ridiculous; it is positively a short-sighted policy. A weekly, or even monthly, visit to the Glasgow Exchange, would most probably result in purchases and sales being effected at figures which would more than repay the cost. In this matter of coal, for instance, had gas managers been in Glasgow a fortnight ago they would have learned of the coming difficulty, and might have adopted measures to protect themselves, as was done in Edinburgh. The low prices which have been secured there will certainly not be obtained by others. Not to speak of the effect of the war, the advances which have been granted to the miners will not be withdrawn, even should the Welsh dispute end in favour of the masters. This is sufficiently vouched for by the action of the miners in the Lothians, who, acting on the advice of their leader, have accepted an advance of 20 per cent., "while the Welsh dispute lasts," with an intimation that they will resist it being taken away when the dispute ends. There is thus ground for considerable anxiety and disappointment by those who have not fixed their coal contracts.

On the same subject, I observe that in Forfar the Corporation this week gave instructions that coal supplies be advertised for; but the remark was made that there need be no hurry in entering upon contracts, as the coal trade is in a very unsettled state. They are probably right not to close immediately with tenderers, because the Welsh dispute cannot last long—the war, for one thing, may be expected to bring it to an end—but they need not put off indefinitely in the expectation of prices coming back to what they have been. It might be worth while considering whether a six months' contract should not be entered into; but as to that, every manager must act according to his own light, and his own judgment as to the course of the diplomatic world.

In Falkirk, the Corporation recently appointed an official gas-tester. The appointment was not made altogether harmoniously, which probably may be the reason that there has been some friction since. It appears the tester reported that, proceeding with the utmost fairness, and in the presence of the Gas Manager, he found the illuminating power of the gas to vary from about 20 to 24 candles. He was unable to account for the fluctuations. In order to satisfy themselves, the Works Committee called in the services of Messrs. Tatlock and Thomson, analysts, of Glasgow; and Mr. Thomson reported that he had tested the gas and found it to be 22¼ and 23⅛ candles. But he added the important remark that the temperature of the gas was 53°; whereas it should not be under 60°. He suggested that the cause of the variation might be that the gas which was being tested was drawn from a holder into which gas was passing at the time of the tests. The Town Council had a talk over the matter this week, and resolved to do nothing in it in the meantime. It is difficult to say what they could do, unless they were to instruct their Manager to use more enrichment.

The London correspondent of the "Scotsman" announces that the Edinburgh Gas Bill is not to be further opposed. The Corporation cannot be too highly complimented upon their obtaining the site for the new works, and the parliamentary powers for the construction of the works, upon such favourable terms, and with so little trouble. The policy has, from first to last, been a very masterpiece. It is a perfect example of a body knowing what they wanted before they asked for it, and, having made up their mind, going straight for their object, without introducing side-issues of any sort.

There is a Captain Clink on the Greenock Police Board whose policy seems to be, like that of the other captain read of in fiction—Cuttle by name—to overhaul his book, and, when found, to make a note of. But,

GAS AND WATER COMPANIES STOCK AND SHARE LIST.

Referred to on p. 933.

Issue.	Share.	When ex-Dividend.	Dividend or Dividend & Bonus.	NAME.	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment.
£			p. c.	GAS COMPANIES.			£ s. d.
590,000	10	Apl. 15	10½	Alliance & Dublin 10 p. c.	23¾—24¼*	+⅛	4 5 9
100,000	10	"	7½	Do. 7 p. c.	16—17*	..	4 8 3
300,000	100	Jan. 3	5	Australian 5 p. c. Db. .	105—107	..	4 13 6
200,000	5	Nov. 11	6†	Bombay, Ltd.	5⅜—6⅛	..	4 16 0
40,000	5	"	6†	Do. New, £4 paid .	4⅜—5⅛	..	4 11 5
380,000	Stk.	Feb. 24	12	Brentford Consolidated	293—298	..	4 0 6
240,000	"	"	9	Do. New	223—228	..	3 18 11
50,000	"	"	5	Do. 5 p. c. Prf.. .	140—145	..	3 9 0
159,375	"	Dec. 15	4	Do. 4 p. c. Db. Stk.	134—138	..	2 18 0
220,000	Stk.	Mar. 30	11½	Brighton & Hove Orig. .	276—275	..	4 3 8
218,820	"	"	8½	Do. A. Ord. Stk. .	195—200	..	4 5 0
933,500	Stk.	Feb. 24	5	Bristol, 5 p. c. max. .	127—132	..	3 15 9
420,000	20	Ma . 30	11½	British	55—56	..	4 0 4
50,000	10	Mar. 11	11½	Bromley, Ord. 10 p. c. .	25—27	..	4 5 2
75,000	10	"	8½	Do. 7 p. c. .	20—22	..	3 17 3
500,000	10	Oct. 14	6	Buenos Ayres (New) Ltd	9—9½	..	6 6 4
98,122	Stk.	Dec. 30	4	Do. 4 p. c. Db. Stk.	98—100	..	4 0 0
150,000	20	Mar. 11	8½	Cagliari, Ltd. . . .	30½—31½	..	5 4 9
100,000	10	Sep. 30	8	Cape Town & Dis., Ltd.	16—17	..	4 14 2
50,000	50	Nov. 2	6	Do. 6 p. c. 1st Mort.	59—61	..	4 18 5
550,000	Stk.	Apl 15	13½	Commercial Old Stock .	333—335*	..	4 0 7
200,750	"	"	10½	Do. New do. . .	250—255*	..	4 2 4
200,750	"	Dec. 15	4½	Do. 4½ p. c. Db. dc.	150—155	−3	2 18 1
800,000	Stk.	Dec. 15	12	Continental Union, Ltd.	215—225	−10	5 6 8
200,000	"	"	9	Do. 7 p. c. Prf. .	200—210	−4½	4 5 9
51,600	Stk	Feb. 24	14	Croydon A 10 p. c. . .	310—315	..	4 8 11
168,400	"	"	11	Do. B 7 p. c. . .	255—265	..	4 3 0
535,000	Stk.	Feb. 24	5½	Crystal Palace Ord. 5 p c.	128—133	..	3 18 11
60,000	"	"	5	Do. 5 p. c. Prf. .	142—145	+2	3 9 0
496,090	10	Jan. 27	11	European, Ltd. . . .	23¾—24½	..	4 9 9
354,060	10	"	11	Do. £7 10s. paid .	17—18	..	4 11 9
5,922,110	Stk.	Feb. 10	12½	Gaslight & Coke, A, Ord.	282—287	..	4 9 0
100,000	"	"	4	Do. B, 4 p. c. max. .	118—123	..	3 5 1
665,000	"	"	10	Do. C, D, E, 10 p c. Prf.	305—310	−2½	3 4 6
30,000	"	"	5	Do. F, 5 p. c. Prf. .	150—155	..	3 4 6
60,000	"	"	7½	Do. G, 7½ p. c. do. .	220—225	..	3 6 8
1,300,000	"	"	7	Do. H, 7 p .c. max. .	195—200	..	3 10 0
463,000	"	"	10	Do. J, 10 p. c. Prf. .	303—308	−4½	3 4 11
476,000	"	"	6	Do. K, 6 p. c. Prf. .	184—189	..	3 3 6
1,061,150	"	Dec. 15	4	Do. 4 p. c. Db. Stk. .	132—135	−1	2 19 3
294,850	"	"	4½	Do. 4½ p. c. do. .	150—155	..	2 18 1
958,000	"	"	6	Do. 6 p. c. do. .	202—207	..	2 18 0
70,000	10	Oct. 28	8	Hongkong & China, Ltd.	14—15	..	5 6 8
3,800,000	Stk.	Nov. 11	10	Imperial Continental .	213—218	..	4 11 9
376,400	100	Feb. 1	4	Do. 4 p. c. Dbs. Red.	98—101	..	3 19 3
473,600	Stk.	Feb. 10	3½	Do. 3½ p. c. Db. Stk. "	103—106	..	3 6 0
560,000	100	Apl. 1	5	Met. of Mel- 5 p. c. Db.	110—112	..	4 9 3
250,000	100	"	4½	bourne 4½ p.c. Db.	107—109	..	4 2 7
75,000	5	Dec. 15	6	Malta & Medn., Ltd. .	5½—6	..	5 0 0
541,920	20	Nov. 11	5	Monte Video, Ltd. . .	15—16	..	6 5 0
617,946	Stk.	Feb. 24	9½	Newc'tle & Gatesh'd Con.	235—240	..	4 1 3
252,355	Stk.	Jan. 3	3½	Do. 3½ p. c. Db. Stk.	115—120	..	2 18 4
150,000	5	Nov. 26	8	Oriental, Ltd. . . .	8—8¼	..	4 14 2
135,000	5	"	8	Do. New, £4 10s. pd.	7—7½	..	4 16 0
15,000	5	"	8	Do. do. 1879, £1 pd.	1½—2	..	4 0 0
60,000	5	Mar. 11	7	Ottoman, Ltd. . . .	4¾—5	..	7 0 0
420,000	100	Nov. 2	6	People's Gas 1st M. Bd.	104—109	..	5 10 1
500,000	100	Dec. 1	6	of Chicago 2nd do.	103—108	..	5 11 1
848,070	10	—	—	River Plate Ord.. . .	2¼—2¾	..	—
250,000	Stk.	Jan. 27	4	Do. 4 p. c. Db. Stk.	99—101	..	3 19 3
250,000	10	Sep. 30	10	San Paulo, Ltd. . . .	16—17	..	5 17 3
135,000	Stk.	Mar. 30	10	Sheffield A.	245—248	..	4 0 8
209,053	"	"	10	Do. B.	245—248	..	4 0 8
447,427	"	"	10	Do. C.	245—248	..	4 0 8
5,531,250	Stk.	Feb. 24	5½	South Metrop., 4 p.c Ord	132—135	−3	3 17 9
1,460,000	"	Jan. 13	3	Do. 3 p. c. Db. Stk. .	103—106	..	2 16 7
60,000	Stk.	Mar. 11	12	Tottenham and A. .	285—295	..	4 1 4
60,000	"	"	9	Edmonton B. .	205—215	..	4 3 9
182,380	10	Dec. £0	7	Tuscan, Ltd.	13—14	−½	5 0 0
149,900	10	Jan. 3	5	Do. 5 p. c. Dbs. Red. .	160—103	..	4 17 1
				WATER COMPANIES.			
746,164	Stk.	Dec. 30	10½	Chelsea, Ord.	320—330	..	3 3 8
150,000	"	"	5	Do. 5 p. c. Prf. . . .	177—180	..	2 15 6
160,000	"	"	4½	Do. 4½ p.c. Pf. Stk., 1875	157—160	..	2 16 3
175,785	"	Mar. 30	4½	Do. 4½ p. c. Db. Stk. .	158—163	..	2 15 3
1,720,560	Stk.	Apl. 15	8	East London, Ord. . .	223—228*	..	3 10 2
654,740	"	Dec. 30	4½	Do. 4½ p. c. Db. Stk.	158—162	−2	2 15 7
390,000	"	"	3	Do. 3 p. c. Db. Stk..	105—107	..	2 16 1
700,000	"	Dec. 15	7½	G'd Junct'n, 10 p. c. max.	115—120	−3½	3 2 6
310,000	Stk.	Mar. 30	4	Do. 4 p. c. Db. Stk.	143—148	..	2 14 1
708,000	Stk.	Feb. 10	13	Kent	358—363	..	3 11 8
160,000	"	"	7	Do. New, 7 p. c. max..	213—218	..	3 4 3
1,043,800	100	Dec. 30	10	Lambeth, 10 p. c. max. .	295—300	−3	3 6 8
406,200	100	"	7½	Do. 7½ p. c. max..	228—233	..	3 4 4
350,000	Stk.	Mar. 30	4	Do. 4 p. c. Db. Stk.	140—145	..	2 15 2
500,000	100	Feb. 10	13	New River, New Shares	440—445	−3	2 18 5
1,000,000	Stk.	Jan. 27	4	Do. 4 p. c. Db. Stk.	142—147	..	2 14 5
902,300	Stk.	Dec. 15	6	Southw'k & V'xhall, Ord.	155—160	..	3 15 0
126,500	100	"	6	Do. do. 7½ p. c. max. .	152—157	..	3 16 5
489,200	Stk.	"	5	Do. do. 5 p. c. Prf. .	174—179	..	2 15 10
1,019,585	"	Apl. 15	4	Do. 4 p. c. A Db. Stk.	143—146*	..	2 14 10
1,155,066	Stk.	Dec. 15	10	West Middlesex . . .	300—305	−3	3 5 7
200,000	"	"	4½	Do. 4½ p. c. Db. Stk.	160—165	..	2 14 7
200,000	"	Mar. 11	3	Do. 3 p. c. Db. Stk.	105—107	..	2 16 1

* Ex div.

† Next dividend will be at this rate.

however much he may have been overhauling his landmarks, he has as yet only made one decided note, and that is to the effect that the gas in Greenock is bad. He has said so before; and he said it again, at a meeting of the Board on Tuesday. Nay, the belief that he has made a discovery is growing inward upon him; and whereas formerly his plaint was that the gas was bad, it now is that it is "really not gas at all." In his opinion, it is high time they had some other light in the town, because the present state of matters is likely to go on until they will be all using oil. It would probably be rash to assume from this expression that Captain Clink is in favour of the use of oil; I rather take it that what was in his mind was that, unless the gas were improved, the community might so far forget themselves as to return to the use of oil. This view is quite consistent with the further notion that perhaps Captain Clink has aspirations after something which he looks upon as superior to gas for lighting purposes. If that were so, it would be the most natural thing for him to try to depreciate gas. There is usually a bombardment—in which the noise is more impressive than the blows—before an assault takes place. Captain Clink may, therefore, be looked upon as, in the meantime, playing the preliminary *rôle* of a party who wish to introduce (say) the electric light. Whether this is really so or not, it is open to anyone, in this free country, to attack anything; but there are circumstances, and even ceremonies, which must be observed. Before, for instance, Lord Wolseley could accept the command of a hostile foreign army, he would require to lay down the command of ours. It follows that, before Captain Clink can stand in his place and denounce the gas supplied by the Corporation (himself included) to the community of Greenock, he ought to cease to be a member of the Police Board. Captain Clink was very properly reproved for his conduct by Mr. Mitchell, the Convener of the Gas Trust, who pointed out to him that, while he complained about the gas, his own gas accounts kept on increasing. Taken all in all, Captain Clink oversteps the bounds of discretion; and in so doing, he destroys any position he might have been able to make if he had acted with moderation. His remarks, if they prove anything, confirm that the gas supplied in Greenock is not of bad quality.

There is every probability, for which there can only be gratification, of the difference between the Corporation of Aberdeen and the Great North of Scotland Railway Company being amicably settled before the Company's Bill is taken before a Parliamentary Committee. The Company are seeking powers to extend their goods yard in Aberdeen; and their plans show that a corner of the gas-works would be taken. This was objected to by the Corporation, who consider that they require all their space about the works; and they have petitioned against the Bill. The proposal which has found acceptance is that the Railway Company should purchase a church, and alter their plans so as to leave the gas-works untouched. The church managers have been asked to name their price.

Fylde Water-Works Purchase Question.—Sir George B. Bruce has been appointed to represent the Fylde Local Authorities, and Mr. James Mansergh the Water Company, in the arbitration which is to be held to determine the price to be paid by the former for the water undertaking. The arbitration has, however, been postponed for six months.

CURRENT SALES OF GAS PRODUCTS.

LIVERPOOL, *April* 23.

Sulphate of Ammonia.—The market has been somewhat irregular at the different points; but, on the whole, it has been fairly steady—quotations being £8 13s. 9d. to £8 16s. 3d. per ton f.o.b. at the ports. Export demand has been for early or immediate shipment; and full prices have been paid in the case of urgent orders. The rupture between Spain and the United States is causing some uneasiness with regard to shipments to these countries; but it yet remains to be seen how far the trade is likely to be disturbed by actual hostilities. Home demand continues to be satisfactory; and the present smaller output in England is being absorbed as fast as it becomes available. In Scotland supplies are more abundant; and this is perhaps now the weakest market, though home consumption is still an increasing quantity. For second half May and June delivery, there would be sellers at about 2s. 6d. per ton under to-day's prices; but this position is not attracting much attention.

Nitrate of Soda is somewhat firmer in the forward position; but spot quotation remains 7s. 4½d. per cwt. for fine quality.

LONDON, *April* 23.

Tar Products.—A little more life characterizes pitch; and business for next season is reported at a marked improvement in price. Buyers are more numerous, but mostly desirous of entering into business for forward delivery. The present shipping season is rapidly closing; and it will be found that stocks in makers' hands will be much below normal quantities. The slump in benzols continues; and low prices are being accepted for prompt delivery, while for forward delivery, July-December, only a fraction more than to-day's quotations can be obtained. Large quantities are already being taken up for enriching gas, notably in provincial works—in one instance, amounting to several thousand gallons per week. This outlet is certain to extend so long as prices are low; and we may sooner see the end of an over-stocked market than some think. Carbolic acid is much inquired after; and, although crystals do not respond to the advanced price of crude, they will undoubtedly do so as the summer advances. Much lower prices are being accepted for tar; one important contract during the week having been let at less than half that paid for the same tar during the previous year.

To-day's average values of products are as follows: Tar, 10s. to 13s. 6d. Pitch, east coast, 20s. 6d.; west coast, 17s. 6d. Benzols, 90's, 10d.; 50's, 11d. Toluol, 1s. 2½d. Solvent naphtha, 1s. 3d. Heavy naphthas, 1s. 1d. Crude, 30 per cent., naphtha, 4½d. Creosote, 2½d. Heavy oils, 45s. to 50s. Carbolic acid, 60's, 2s. 1d. Naphthalene, 55s.; salts, 33s. Anthracene, "A," 5d.; "B," 4d.

Sulphate of Ammonia.—Conflicting reports exist in this market; and quotations in the several centres are largely influenced by local considerations; the operator being very evident in certain quarters, as will be seen by to-day's quotations at the following ports: Beckton, £8 10s.; London, £8 15s.; Hull, £8 12s. 6d.; Leith, £8 15s.; Newcastle, £8 11s. 3d.; Middlesbrough, £8 10s.; Liverpool, £8 16s. 3d. to £8 17s. 6d.; Glasgow, £8 15s.—usual terms, less 3½ per cent., unless otherwise expressed, bags included, and delivered f.o.b.

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COAL TRADE REPORTS.

From Our Own Correspondents.

Lancashire Coal Trade.—The extra shipping demand upon all descriptions of fuel, owing to the continued South Wales dispute, is decidedly strengthening the position of colliery proprietors in this district. Not only have pits been kept on full time, but a good deal of stock which threatened to hang on their hands during the summer has been disposed of; while surplus supplies of either round coal or engine fuel generally meet with ready sale for shipment. The inland demand continues fairly steady for house-fire qualities, with full average requirements for steam, forge, and general manufacturing purposes; and engine fuel is in fairly good request. So far as inland pit prices are concerned, it is only in exceptional cases that colliery proprietors have actually put up their best rates; but here and there advances of 1s. per ton are announced on round coal. The general effect, however, has been to harden up prices to the full list quotations; and there is also a disinclination to entertain inquiries for forward contracts at current rates. For gas coal, tenders that have been sent in have in some cases been based on 6d. to 9d. per ton over last year's prices; and there is a general anticipation that this may represent the advance which colliery proprietors will endeavour to secure during the ensuing season. On contracts for manufacturing classes of fuel, advances of 1s. to 1s. 6d. per ton are in some cases talked of; but these can scarcely be said to represent quotations on which any actual business is likely to be secured. They rather indicate that colliery proprietors prefer not to quote at all for the present. Taking the position all through, there would seem to be a probability that on round coals of all descriptions, for either gas making, locomotive, iron making, or general manufacturing requirements, there will be a hardening up of perhaps 6d. per ton upon the prices that were accepted for contracts last summer. At the pit mouth, the general current quotations may be given at about 10s. 6d. to 11s. 6d. per ton for best Wigan Arley coals; 8s. 6d. to 9s. 6d., for Pemberton four-feet and seconds Arley; 7s. to 7s. 6d., for common round coals; 3s. 3d. to 3s. 6d. for common engine fuel; 3s. 9d. to 4s. 3d., for medium sorts; and 4s. 9d. to 5s. 3d., for best sorts. For shipment, advances, generally of about 2s. per ton, and in some cases of 2s. 6d., on the prices ruling prior to the South Wales dispute are still being obtained. Delivered at the ports on the Mersey, ordinary steam coal averages 10s. to 10s. 6d. per ton, with better qualities fetching 11s. 6d. up to 12s. 6d. in some cases.

Northern Coal Trade.—There has been a strong demand for coals, and that not only for steam but for gas and other qualities. The effect of the strike in South Wales has been to cause an enormous fleet of steamships to come to the Northern ports for fuel; and prices have irregularly advanced. Best Northumbrian steam coals are quoted at from 15s. to 18s. per ton f.o.b. Second qualities are about 13s.; and steam smalls, 6s. In regard to gas coals, the demand has increased, both for home use and for export; and as a large tonnage has been sold for other uses—such as manufacturing and bunkering—there has been a higher price, and the quotation is now from 8s. to 9s. per ton f.o.b. No additional contracts of moment have been made of late for gas coals. The prices named are swollen by the effect of the additional demand; and should the strike in Wales terminate, there would be a considerable fall. Gas coke is steady; the exports being larger, and the stocks kept down by the diminished make. Prices are unaltered.

Scotch Coal Trade.—In Scotland, the coal trade is passing through a period of excitement, consequent upon the dispute in Wales. There is a very large demand for Scotch coal, both for home consumption and for shipping. Stocks are disappearing fast. This state of matters has been taken advantage of by the miners to demand an advance of wages. It was reported that in the west last week the coalmasters had granted an advance of 6d., and that, on account of dissatisfaction on the part of the men, some masters had conceded the full demand of 1s. Since then all the masters have granted the 1s. per day; and the men are working steadily. In the Lothians, the masters have intimated a 20 per cent. advance as from the 25th inst., to continue during the Welsh dispute. This has been accepted. In Fife, where a demand of an advance of 25 per cent. was made, the masters have conceded 12½ per cent.; but the men want more, and are holding idle days to discuss the matter. The "Glasgow Herald" reports the price of coal to be about 10s. to 10s. 6d. per ton f.o.b. Glasgow; but another newspaper, which seems to be more reliable, gives the quotations as: Main, 10s. 6d. per ton; ell, 11s. 6d.; splint, 11s.; and steam, 13s. 6d. The shipments for the week amounted to 212,875 tons—an increase of 34,167 tons over the preceding week, and of 49,495 tons over the corresponding week of last year. For the year to date, the total shipments have amounted to 2,077,651 tons—an increase over the same period of last year of 125,347 tons.

Use of Water-Meters in Philadelphia.—In Philadelphia, where some trouble is experienced in obtaining a proper supply of water, an attempt is being made to prevent waste by the use of meters. To this, some objection is being made. In commenting on the subject, the "Ledger" makes the following observations: "There should be no more opposition to water-meters than there is to gas-meters, and there would not be if people were as well accustomed to the one as to the other. Their use is based on the same principle; and while there may be some difference in their application, since water is a necessity while gas is not, this is not enough to invalidate the principle. The use of water-meters should be made compulsory and universal. It is true that water must be supplied to some persons who cannot pay for it; but it should be measured in every case, and the question of free delivery settled by itself. Measuring the water and paying for it are distinct questions, and need not be dealt with as inseparable. The use of meters is demanded as the only means to stop waste. At least half the water supplied to this city is wasted; and the waste not only costs as much money as the amount used, but it impairs the quality of the whole by withdrawing the water from the reservoirs before it has time to purify itself by subsidence. The introduction of meters would be the quickest way of affording relief in the water difficulty; and while it would not solve the problem, it would help to preserve the health and comfort of the people while waiting for a pure water system to be selected and installed."

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Preventing the Pollution of the Bristol Water Supply.—The Bristol Water Company are doing their utmost to prevent the pollution of the new reservoir they are constructing in the Yeo Valley. A large drainage scheme has been devised by their Engineers, which will consist of intercepting sewers at the base of the watershed above the embankment, taking the drainage from the villages of Compton Martin, Ubley, Butcombe, and Blagdon. The sewage will be taken to a suitable point below the dam, where it will be properly treated; and the harmless effluent will find its way into the River Yeo. The Axbridge Rural Sanitary Authority have given consent to the proposed scheme, which, when carried out, should be sufficient to set consumers' minds at rest as to the possibility of any contamination of the water derived from this source.

Bombay Gas Company, Limited.—The report which the Directors of the Bombay Gas Company, Limited, will present to the proprietors at the ordinary general meeting on the 12th prox. opens with the statement that during the past year the whole of the public lamps were lighted on the incandescent system, which is giving great satisfaction. Owing to the continued prevalence of the plague, which has so disastrously affected the condition and industries of Bombay, there was a considerable diminution in the consumption of gas by private consumers, the revenue from this source being £3834 less than in the previous year. There was a small increase in the cost of coal, due to higher freights, though 1110 tons less were used; and the receipts from residuals were reduced, owing to the smaller quantity of coal carbonized. The exchange account amounts to £14,447, which is less by £6154 than that of the previous year. Deducting the interim dividend of 3 per cent. paid in December last, amounting to £7200, there is left for distribution £5944; and the Directors recommend a dividend of 3 per cent. (making 6 per cent. for the year), to pay which £1255 will have to be taken from the reserve.

Exeter Water Supply.—It was recently decided by the Exeter City Council to apply to the Local Government Board for leave to borrow a sum of £30,000 for works of water supply. Of this expenditure, £25,000 had previously been determined upon; and the additional £5000 is to cover the cost of an iron conduit in place of the present brick culvert at Pynes. The scheme proposed to be carried out is of a very comprehensive character, and was prepared by Mr. Donald Cameron, the City Surveyor, on the approval of Mr. H. Law, M.Inst.C.E. It provides for the removal of the filter-beds to Pynes, and an increase of the filtering area; the removal of all pumping power to Pynes, and an increase in this power; and additional storage and mains. As all the water will be filtered on one site, the necessity for the intermediate pumping-station at Dane's Castle will be done away with. A new reservoir is to be provided for the increased supply of the high-level district; and this, with the enlargement of existing reservoirs, will raise the total storage capacity to 10,209,900 gallons. In order to concentrate the work of pumping and filtration at Pynes, it is necessary to acquire about 3 acres of additional land; the Corporation being already owners of 1¾ acres there. By means of the proposed works, it is hoped not only to avert the difficulty now experienced in times of frost or drought in maintaining the supply, but to provide adequately for the wants of the city for possibly thirty years to come.

An Unfounded Rumour as to the Resignation of Mr. S. B. Darwin.—The "Hampshire Telegraph" last Saturday gave publicity to the following: "We have received intelligence to the effect that, in consequence of recent action on the part of the Board of Directors of the Portsea Island Gas Company, Mr. S. B. Darwin, the Secretary and Manager, has tendered his resignation, to take effect at the end of six months. Mr. Darwin has occupied his present position for twenty years; and his rumoured resignation has come as a surprise to the officials of the Company." In reply to an inquiry as to the truth of the rumour, Mr. Darwin telegraphs that he has not resigned, nor does he intend doing so.

The Purity of the Water Supply of Chester.—If any suspicions linger in the minds of Cestrians in reference to the purity of the water supply of the city, which has been so often called in question, they ought to be effectually banished by the report which has been sent to the Medical Officer of Health for the city by Dr. Percy Frankland, of Mason College, Birmingham, who has subjected samples of the water to chemical and bacteriological examinations. He states that the water was very effectually filtered, because out of every 1000 bacteria present in the unfiltered water no less than 997 had been removed in the process of filtration. On the whole, he is of opinion that the Chester water, as represented by the filtered samples, is of good quality for drinking and all domestic purposes.

Additional Pumping Plant at the Ipswich Water-Works.—An important addition to the pumping machinery at the Ipswich Water-Works was inaugurated last Thursday. The engine is a triple-expansion Worthington, and has been designed to pump 2 million gallons in 24 hours, working with a steam pressure of 70 lbs., or 120 lbs. per square inch. It is of the horizontal type; the cylinders being arranged in line with the pump plungers, thereby transmitting their effort without the intervention of any intermediate gear or connections. The diameters of the cylinders are: High pressure, 9½ inches; intermediate, 14 inches; low-pressure, 24 inches—the stroke being 28 inches. Each cylinder is steam jacketed, and both cylinders and equilibrium pipes are lagged with sheet steel. The steam-valves on all the cylinders are of the Corliss type, and are arranged on the top. The pump is double acting; and the surface condenser is arranged on the top. The engine has been designed throughout to meet severe conditions of working due to the suction lift and the special nature of the service; and it forms a reserve to the existing Worthington, erected in 1894. Steam is supplied by a steel Lancashire boiler, provided throughout with the latest and most improved fittings. At the back of the boiler and in the main flue a Schwoerer superheater is fixed, the pipes of which form part of the main steam-pipe, so that the whole of the steam generated by the boiler passes through it. The flue gases, on their way to the chimney circulate on the outside, so that when the steam reaches the engine, a superheat of about 100° to 120° Fahr. is obtained. The installation has been carried out to the requirements and specifications of Mr. Hamlet Roberts, Assoc.M.Inst.C.E., the Engineer to the Corporation; and the whole has been manufactured and erected by Messrs. J. Simpson and Co., of Grosvenor Road, Pimlico, to the satisfaction of everyone concerned.

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Manufacture of Gas at Oldham.—The Engineer of the Oldham Corporation Gas-Works (Mr. John Chadwick) has reported to his Committee that the quantity of gas manufactured at the various works during the year ending March 25 last, was 1,094,360,670 cubic feet, and that 7931 tons of cannel and 99,929 tons of coal were used in its production. The quantity of gas manufactured in the previous year was 2,627,560 cubic feet more. This, he states, is not a large decrease considering the long stoppage of work in the iron trade; and it may therefore be considered a satisfactory result.

Smethwick Gas Supply.—At the last meeting of the Smethwick District Council, the Gas Committee reported that they had passed accounts for payment amounting in the aggregate to £4273, including a contribution of £2000 to the district rate fund, from the gas profits of 1897. They had come to the conclusion that the time had arrived for enlarging the productive capacity of the gas-works; and they had accordingly invited tenders for the erection of a new retort-house with four beds of retorts on the inclined system. They also recommended that the Clerk be instructed to make immediate application to the Local Government Board for sanction to a loan of £12,000 to defray the cost of the new house, and to provide for additional outlay on mains and meters. The report was adopted.

Gas Explosion in Leeds.—A somewhat serious gas explosion occurred on the morning of the 16th inst. in the cellar of a house and shop in Stainburn Square, Leeds. Inspector Mason, who had his attention directed to the occurrence, proceeded to the spot, and found that considerable damage had been done to the premises. It seems that a number of workmen from the Corporation Gas Department had been laying a service-pipe in the cellar, and while the foreman, William Robinson, was about to make the connection, the explosion occurred. Robinson, who was burned about the face, neck, and hands, was taken to the York Street works and attended to, and afterwards removed to the Infirmary. Mr. Townsley, the Manager, was sent for, and he had the square barricaded and a watchman left in charge, as it was seen that it would be unsafe to allow people to approach the damaged building.

Subways in the City of London.—In the report of the Engineer to the Public Health Department of the Corporation of London (Mr. D. J. Ross, M.Inst.C.E.) on the works executed last year, noticed in another column, some information is furnished with regard to the subways for gas, water, and other pipes, and the extent to which they are used. Beneath the City streets there exist at the present time about 2360 yards, or nearly 1¼ miles, of subways. The lengths of gas, water, and hydraulic mains, and telegraph conduits, pneumatic tubes, and electric lighting conduits, laid in these subways, amount to a total of 7¾ miles. The electric light and telegraph conduits contain about 424 miles of wires and cables. Access, under proper supervision, is given to the officers and workmen of the various companies. The Inspector in charge reports that 5073 workmen and others were admitted during the year for various purposes. The usefulness of these subways is evidenced by the fact that in the streets beneath which they have been constructed no openings have been made for access to pipes, &c., except those for taking pipes into the ends of the subways, since they were constructed.

Shrewsbury Water Scheme Condemned.—After nearly forty years' discussion of water schemes, Shrewsbury finds itself to-day not a step in advance. River and upland projects of supply have had their advocates; and the last scheme of the Corporation was to take water from the Severn, near Berwick, filter it, and supply it to the town from a reservoir near Hanwood. This was strenuously opposed, but carried; and application was made for authority to raise the necessary funds by way of loan. A full inquiry was held some months ago by a Local Government Board Inspector; and the result is that a communication has been received by the Town Clerk which amounts to a refusal to sanction the loan.

Buenos Ayres (New) Gas Company, Limited.—At the annual general meeting of this Company next Thursday, the Directors will report, as a result of the past year's working, a profit of £52,849, to which has to be added the balance of £3989 brought forward from last year; making a total of £56,838. After payment of the fixed charges, depreciation of services, &c., and the cost of various improvements, there remains to be dealt with the sum of £34,681. From this amount £12,500 has already been paid to the shareholders as an interim dividend; and the Directors now recommend a final dividend of 7s. per share (or £17,500), making 6 per cent. (free of income-tax) for the year—leaving £4631 to be carried forward.

Wokingham Gas-Works Extensions.—In the first number of the "JOURNAL" published this year, we briefly reported the proceedings at an inquiry held by the Local Government Board at Wokingham relative to an application by the Town Council for a loan of £1500 for gas-works purposes. The inquiry took place on Dec. 23; but the Council have only just been informed by the Board that they are not prepared to sanction a loan for the execution of the scheme. The ground of their refusal is that the Council have acquired land on which it is proposed to erect a gasholder; but they had no power to purchase it, nor have they power to use it for the storage of gas. The Council find that the only way out of the difficulty is to obtain a Provisional Order and the consent of owners of adjacent properties to the land being used for manufacturing or storing gas; and they have decided to proceed accordingly.

Stalybridge Gas Affairs.—The Stalybridge Corporation Gas Department is showing the effect of the application to its affairs of the well-known progressive policy of Mr. William Carr, the Engineer and Manager. At the meeting of his Committee last Wednesday, he had the pleasure of reporting a profit for the past year of considerably over £2000. The meeting of the Committee was called to vote a subsidy to the borough fund, and to consider what to do with the remainder of the money. The subsidy was fixed at a third of the total profits—viz., £775—and it was decided to make a further reduction in the price of gas as and from March 25 of 2d. per 1000 cubic feet; making it 2s. 6d. to ordinary consumers, as against 2s. 10d. when Mr. Carr took over the management. The subsidy of £775 will allow of a reduction in the borough rate of 2d. in the pound, so the gain to the ratepayers is most substantial. When the gas-works became the property of the Corporation the price charged throughout the district was 3s. 3d.

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LINDSAY (Remodelled)	125,000
MONTREAL	500,000
BELLEVILLE	250,000
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WILKESBARRE, PA.	750,000
ST. CATHERINES (Second Contract)	250,000
BUFFALO, N.Y.	1,500,000
WINNIPEG, MAN.	500,000

Discovery of Coal near Ballycastle.—A large bed of coal, some 4 ft. 6 in. thick, covering an area of about 500 acres, has been discovered near Ballycastle, County Antrim. For some time past a local Syndicate have been making investigations, and, according to the report of Mr. G. J. Kell, a mining engineer of Barnsley, the field contains upwards of 2½ million tons of coal.

Beverley Water-Works Company.—The report of the Directors of this Company, presented at the seventeenth ordinary meeting held on Monday last week, stated that the income for the past year was £1461, against £1363 for the previous year. During the same period, the working expenses were £674, which was £41 more than before. The Directors recommended a dividend of 4s. 6d. per share, free of income-tax.

Reconstruction of the Water Distribution System at Reading.—Two years ago the Reading Town Council authorized the reconstruction of the water distribution system; and the work has now been satisfactorily completed. The estimate was £8645; but the whole work has been carried out at a cost of £7422. The estimate included about £800 for contingencies which have not arisen; but making allowance for this and other items, a saving of £500 or £600 has been effected. Every pipe is now under 3 feet of earth, and is of such a capacity as will serve the town for a long time to come.

Tarapaca Water-Works Company, Limited.—At the annual general meeting of this Company held on Monday, the 18th inst., the Chairman (Mr. R. Harvey), in moving the adoption of the report, noticed last week, said the receipts in the aggregate had been £8174 less than those of the previous year; this result being entirely owing to the abnormally depressed state of the nitrate industry. The sales at the depôt at Iquique had, however, slightly increased, having been 17¼ million gallons, as compared with 16¼ million gallons in the previous year. The number of meters had increased by 33, to 896. The reduction in the sales had really amounted to £9268; but against this they had reduced their expenses. The net profit for the year was £40,404. All the plant was in excellent condition. The mains had been under pressure for ten years; and they had decided to have them cleaned out. This would cost about £1000; but it was necessary work in order that they might be prepared for any call on them for an increased supply. They proposed to pay a final dividend of 4 per cent., making 7½ per cent. for the year; to place £10,000 to the account for redeeming debentures; and £10,000 to general reserve; leaving £8050 to be carried forward. The motion was adopted.

The Directors of the Oriental Gas Company, Limited, have resolved to pay an interim dividend at the rate of 3½ per cent., free of income-tax, on account of the year ending the 30th of June next; being at the same rate as last year.

Contracts have lately been entered into with several firms for the supply of plant for the Glasgow Gas-Works. Messrs. R. Laidlaw and Son will furnish two new station meters of large capacity, and Messrs. Bryan Donkin and Co. and Messrs. G. Waller and Co. new exhausters, for the Dawsholm station; while the Airdrie Iron Company and the Barrowfield Iron-Works Company will supply castings and casings for the oil-gas plant at the Temple station.

Messrs. Graham, Morton, and Co., Limited, have sent to all gas engineers at home and abroad an illustrated and descriptive pamphlet on "The Construction and Erection of Inclined Gas-Retorts, Charging Apparatus, and Elevating and Conveying Machinery." It is a reprint of the paper read by Mr. Graham at the meeting of the Birmingham Association of Mechanical Engineers on the 5th ult. (see *ante*, p. 588), with the addition of photographic reproductions; and it embodies most of the important improvements brought out since the introduction of inclined retorts.

Exhibitions of gas appliances have lately been held by the following firms: Messrs. Arden, Hill, and Co., at Shepherd's Bush, Godalming, and Longsight (Manchester); the Davis Gas-Stove Company, Limited, at Plymouth, with lectures by Miss M. E. Betts; Messrs. R. & A. Main, at Perth, with lectures by Miss Burden; Messrs. Fletcher, Russell, and Co., Limited, at Gorleston, with lectures by Miss E. E. Golding, and at Totterdown (Bristol), with lectures by Miss R. Brown; Messrs. W. Parkinson and Co., at Withington (Manchester), with lectures by Miss E. Sanderson; and Messrs. John Wright and Co., Limited, at Southport, with lectures by Miss J. Barker.

The Accrington District Gas and Water Board have had under consideration the extension of their carbonizing plant. The Board, with Mr. Charles Harrison, their Engineer and Secretary, visited several gas-works to inspect different plans in use, and decided to adopt Mr. W. R. Chester's regenerative system. They have placed the order with Messrs. R. Dempster and Sons, Limited, of Elland. The house, which is to hold sixteen settings of eight retorts, is 60 feet span (the roof being carried by girders and columns), and on each side there is a 30-feet span coal-store. The contract for the roofs has also been placed with the Company. The work is to be finished by next autumn.

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[For Illustrated Advertisement, see April 5, p. 794.]

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Before placing Orders, please write for Estimate.

SPENT OXIDE wanted.
BROTHERTON AND CO., Chemical Manufacturers. Works: BIRMINGHAM, LEEDS, and WAKEFIELD.

GAS CARBON Wanted, not less than 4-Ton Loads.
Apply to the BRIMINGTON CARBON COMPANY, Sowerby Bridge, YORKS.

SADLER & CO., Ld., Middlesbrough; ULVERSTON (BARROW); PORTSMOUTH; CARLTON (N.E.R.); and STOCKTON. Tar and Petroleum Distillers. Benzol and Petroleum Spirit, 700 and other Gravities specially prepared for Carburetting. SOLAR OIL for Gas Making, Kerosene, &c.
Correspondence invited.
Telegraphic Address: "SADLER, MIDDLESBROUGH."

SPECIAL PAINT FOR GAS-WORKS.

JOHN E. WILLIAMS AND CO.,
VICTORIA PAINT WORKS,
MANCHESTER.
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JOHN ROMANS & SON, EDINBURGH, Gas Engineers, supply all the most approved SCOTTISH CANNELS; also FIRE-CLAY GOODS, CAST-IRON PIPES, and other APPARATUS for GAS and WATER WORKS.
Prices, &c., will be forwarded on application to No. 30, ST. ANDREW SQUARE, EDINBURGH, } SCOTLAND.
NEWTON GRANGE, NEWBATTLE, DALKEITH, }

IMPORTANT.

OLD Retorts made equal to new by repairing them with CROWTHER'S PATENT STICKFAST FIRE CEMENT. Unequalled for Repairing Inclines. Can be used in Hot or Cold Retorts; and "A1." for Mouthpiece Joints. Satisfaction Guaranteed.
CROWTHER, Practical Retort Setter, Manor Street, HUDDERSFIELD.

HYDRATED OXIDE OF IRON.

PREPARED from pure Iron.
Two or three times as rich as Bog Ore.
Strong action on Sulphuretted Hydrogen.
To be used alone, but will increase activity of other Oxides.
Less than half the price of Bog Ore.
Can be lent on hire.
Write for tabulated results.
READ HOLLIDAY AND SONS, LIMITED, HUDDERSFIELD.

Price 2s., Post Free.

STEPHEN CARPENTER, on the Purification OF COAL GAS BY LIME, OXIDE OF IRON, AND ATMOSPHERIC AIR, and the Method of Working Purifiers so that the Lime may be used a second time, with a Description of Carpenter's short Method of Working off the Sulphur Test, and Table for Calculating Results.
S. CARPENTER, Ryde House, 28, Woodhouse Grove, East Ham, ESSEX.

WATER-GAS PLANT.

ENGINEERS contemplating the above are invited to communicate with the Advertiser, who is prepared to give every assistance in designing Plant of any capacity.
J. L. FEATHERSTONE, 30, Amesbury Avenue, STREATHAM HILL.

WANTED, the post of Manager or MANAGER AND SECRETARY of Gas-Works, 20 to 60 million cubic feet production per annum.
Address W. H. BURTONSHAW, 3, Cavendish Street, Skipton-in-Craven, YORKS.

WANTED, by an Experienced Fitter, an Engagement as METER INSPECTOR or FOREMAN. Practical knowledge of Mains, Services, Meters (including Automatic), Stoves, and Fittings. Would take charge of small Works. First-class Testimonials.
Address No. 3047, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

WANTED, a good Gas-Fitter, used to Iron and Compo, and willing to make himself useful at Main and Service laying. Wages 28s. per week, with House, Coke, and Gas.
Apply to JOHN MORTON, Gas-Works, Ashford, KENT.

STOKER wanted, used to Shovel Charging. Constant employment for a sober and industrious Man. Wages 31s. per week.
Apply to B. BARK, Gas-Works, GODALMING.

WORKS Manager wanted for Gas-Stove Manufactory. Good opening for capable Man.
Apply, by letter, stating Age, Experience, &c., to No. 3045, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

WANTED, a Draughtsman, thoroughly conversant with Gas Apparatus, and able to make Original Drawings from Instructions. State Salary.
Apply, by letter, to No. 3048, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

WANTED, at once, for a small Gas-Works, a steady Man as STOKER. Must be used to Shovel Charging, Engine and Exhauster. Wages, 24s. 6d. in Summer, and 26s. 3d. in Winter. A married Man preferred.
Apply, stating Age, to the MANAGER, Gas-Works, Chepstow, MON.

GAS TUBES AND FITTINGS.

OLD-Established Manufacturer requires an AGENT calling upon all Gas Companies in the United Kingdom. Must have good Connection. Liberal Commission.
Address No. 3039, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

ASSISTANT DRAUGHTSMAN.

WANTED at once, for a time, in the Office of a Gas and Water Engineer at Westminster, a young DRAUGHTSMAN able to prepare Drawings from instructions and sketches.
Apply with Particulars of Experience and stating Remuneration required, to No. 3046, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

CITY OF LEEDS.

THE Gas Committee require the services of an ASSISTANT to the Superintendent of the Mains and Services Department.
Applicants must possess a thoroughly practical knowledge of Main and Service laying, and the Distribution of Gas.
Salary £125 per annum.
Applications, stating Age and Experience, with *copies* of not more than three recent Testimonials, and addressed to the undersigned, endorsed "Assistant Mains Department," will be received not later than Saturday, May 7.
Canvassing Members of the Corporation will disqualify Candidates.
JNO. HARRISON,
Town Clerk.
April 23, 1898.

WANTED, Carbon in 4 Ton Lots, or more.
State Price, f.o.r. at nearest Station, to No. 3031, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

WANTED, a good second-hand Washer, with 6-inch Inlet and Outlet Connections and Bye-pass complete.
State lowest Price to No. 3044, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

PURIFIERS, &c., WANTED.

WANTED, a Four or Six Set of second-hand PURIFIERS, in good condition, not less than 20 feet square. Also a set of WROUGHT-IRON ANNULAR CONDENSERS, ½ to 1 Million capacity, either in single or double set.
Apply, in first instance, to No. 3034, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

FOR SALE — A Modern Sulphate of AMMONIA STILL, built by Messrs. R. & J. Dempster, Manchester, 1893, with separate Liming Compartment. Capacity, with ordinary Liquor, 5000 to 6000 lbs. of Sulphate per day.
For further Particulars, apply to the BRYMBO STEEL COMPANY, LIMITED, near WREXHAM.

CHEAP BENZOL.

AT the present low Prices, Benzol is very much the cheapest Enricher for Gas.
Apply to SADLER AND CO., MIDDLESBROUGH.

FOR SALE—Two small Gas Exhausters (perfectly new); one combined with Steam-Engine.
Apply to SELLERS PICKERING & CO., Gas Engineers, Ravensthorpe, YORKS.

FOR SALE—A Small Gas-Works (Free-hold Property) near London. Production about 1 million.
Apply, in first instance, to No. 3033, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

GAS PLANT for Sale—I can always offer NEW and SECOND-HAND GAS APPARATUS, including Retorts and Fittings, Condensers, Exhausters, Scrubbers, Washers, Purifiers, Gasholders, Tanks, Valves, Connections, &c. Also a few COMPLETE WORKS. **Compare Prices and Particulars before ordering elsewhere.**
J. F. BLAKELEY, Gas Engineer, Ravensthorpe, YORKS.

TO BE SOLD Privately, together or separate, the whole of the GAS-MAKING PLANT, late the Property of the Eynsham Gas Company—
For making COAL GAS: Three Furnace Doors and Frames, two Troughs, four Retort Mouthpieces, with Ascension, Bridge, and Dip Pipes, long Hydraulic Main, two Purifiers, one Scrubber, Pressure Pan, Valves, Gasholder with Fittings, one Station Meter and about 40 other Meters, eight Iron Principals, 19 ft. 6 in. span.
For making OIL GAS: Five Retorts, long Hydraulic Main, Ascension and Dip Pipes, with Tank, Seamless Boiler, and eight Wall Stays.
Apply to TOM BURDEN, Eynsham, OXON.

WIRKSWORTH GASLIGHT AND COKE COMPANY, LIMITED.

THE above Company will be pleased to receive TENDERS for 800 Tons more or less of SCREENED GAS COAL, NUTS, and UNSCREENED GAS COAL, delivered at Wirksworth (Mid.) Station.
Tenders to H. BEESLEY, Esq., Chairman.
Further Particulars from the undersigned.
JAMES LEE,
Secretary and Manager.

CORPORATION OF LEICESTER.

GAS COAL.

THE Gas and Electric Lighting Com-mittee of the above Corporation are prepared to receive TENDERS for the supply of COAL, COBBLES, or NUTS (about 140,000 Tons per annum) for One or Two Years ending May 31.
Particulars and Form of Tender can be obtained on application to the Engineer.
Tenders, addressed to Alderman Lennard, Chairman, and endorsed "Tender for Gas Coal," to be delivered at these Offices not later than Eleven o'clock a.m. on Saturday, May 7 next.
The Committee do not bind themselves to accept the lowest or any Tender.
ALFRED COLSON, M.Inst.C.E.,
Engineer and Manager.
Offices: Millstone Lane,
Leicester, April 19, 1898.

CORPORATION OF LEICESTER.

PURIFIER-GRIDS.

THE Gas and Electric Lighting Com-mittee of the above Corporation are prepared to receive TENDERS for the supply and fixing of GRIDS for seven Purifiers, 32 feet square, in three tiers, at their Aylestone Road Works.
Specification and Form of Tender may be obtained upon application to the Engineer.
Tenders, addressed to Alderman Lennard, Chairman, and endorsed "Tender for Purifier-Grids," to be delivered at these Offices not later than Eleven o'clock a.m. on Saturday, May 7 next.
The Committee do not bind themselves to accept the lowest or any Tender.
ALFRED COLSON, M.Inst.C.E,
Engineer and Manager.
Offices: Millstone Lane,
Leicester, April 20, 1898.

TENDERS FOR GAS COAL.

THE Brentwood Gas and Coke Com-pany invite TENDERS for the supply of about 4300 Tons of screened GAS COAL in Trucks at the Brentwood Railway Station (G.E.R.), at per Ton to be delivered in the following quantities the second week in each Month: June, 140 Tons; July, 160 Tons; August, 300 Tons; September, 500 Tons; October, 550 Tons; November, 500 Tons; December, 560 Tons; January, 500 Tons; February, 350 Tons; March, 300 Tons; April, 250 Tons; May, 190 Tons.
Tenders, with Analysis of the Coal to be supplied, and Terms for Monthly payments, to be sent to the undersigned on or before Monday, the 2nd of May.
The Directors do not bind themselves to accept the lowest or any Tender.
C. A. FIELDER,
Secretary.
Brentwood, Essex,
April 23, 1898.

BOROUGH OF NEWBURY.
(GAS DEPARTMENT.)

THE Gas Committee of the Borough of Newbury are prepared to receive TENDERS for a small GASHOLDER and CAST-IRON TANK, which has to be dismantled. The plant was erected some 60 years ago. The Tank is 31 ft. 5 in. diameter, by 18 feet deep. The four Columns are of Cast-Iron, each about 30 feet high. Parties offering have to give a price for the above *in situ*. No reasonable offer will be refused.

The lowest or any Tender not necessarily accepted.

The Plant may be seen on application; and Tenders are to be sent to

ROBERT M. COUPER,
Manager.

Gas-Works, Newbury,
April 23, 1898.

TENDERS FOR GAS COAL.

THE Corporation of Droitwich invite TENDERS for the supply of from 1100 to 1300 Tons of best screened GAS COAL, to be delivered free at Droitwich (G.W.) Railway Station, at such times and in such quantities as may be required, prior to the 31st of May, 1899.

Particulars and Form of Tender may be obtained on application to the Manager of the Gas-Works.

Sealed Tenders, on the form provided for the purpose (with the Analysis of the Coal to be supplied), endorsed "Tender for Gas Coal," to be sent to the undersigned on or before the 6th of May.

The Corporation do not bind themselves to accept the lowest or any Tender.

S. JOHN TOMBS,
Town Clerk.

Droitwich, April 21, 1898.

TAR AND AMMONIACAL LIQUOR.

THE Accrington District Gas and Water Board are prepared to receive TENDERS for the TAR and AMMONIACAL LIQUOR which may be produced at the Accrington and Great Harwood Works of the Board during the Year from the 1st of July next to the 30th of June, 1899.

Estimated Total Quantity of Tar, 1700 Tons; Liquor, 4200 Tons.

Tenders, endorsed "Tar and Ammoniacal Liquor," must be in my hands on or before Tuesday, the 10th of May.

CHAS. HARRISON,
General Manager.

General Offices of the Board,
Accrington, April 16, 1898.

TENDERS FOR GAS COAL.

THE Directors of the Watford Gas and Coke Company invite TENDERS for the supply during the Twelve Months, from the 1st day of July, 1898, to the 30th day of June, 1899, of 10,000 Tons (more or less) of GAS COAL (screened or unscreened), to be delivered at the Bushey Station of the London and North-Western Railway.

Forms of Tender and Information may be obtained on application (in writing only) of me the undersigned.

Tenders to be delivered on or before the 6th day of May, 1898, addressed to the Chairman of the Watford Gas and Coke Company, Watford, endorsed "Tender for Gas Coal."

Tenders must be on the form supplied, any alteration of which will invalidate the Tender.

The Directors do not bind themselves to accept any Tender.

WILLIAM ROWELL,
Secretary.

Watford Gas and Coke Company's Offices,
Watford, April 16, 1898.

SALES BY AUCTION OF GAS AND WATER STOCKS AND SHARES.

MR. ALFRED RICHARDS begs to notify that his AUCTIONS of STOCKS and SHARES in London, Suburban, and Provincial Gas and Water Companies are held MONTHLY, at the Mart, Tokenhouse Yard, E.C.

He also undertakes the issuing by Auction of Gas and Water Stocks and Shares under Parliamentary Powers.

Terms for issuing such Capital, and also for including Gas and Water Stocks and Shares in these periodical Sales, can be obtained on application at Mr. Alfred Richards's Offices, 18, FINSBURY CIRCUS, E.C.

By order of the Directors of the

SOUTHEND WATER-WORKS COMPANY AND OTHER OWNERS.

MR. ALFRED RICHARDS will Sell BY AUCTION, at the Mart, E.C., on Wednesday, May 11, at Two o'clock, in Lots:—

500 £10 SHARES in the SOUTHEND WATER-WORKS COMPANY; also SHARES in the WEST HAM GAS COMPANY, CHIGWELL, LOUGHTON, and WOODFORD GAS COMPANY, and EPPING GAS COMPANY.

Particulars of the AUCTIONEER, 18, FINSBURY CIRCUS, E.C.

Just Published.

THE SONG OF THE PERIOD

A NATIONAL SONG

Words by A. C. FRASER. Music by G. H. HUCKE.

Copies 1*s.* 6*d. each, Post free.*

Apply to the Publishers, "Victoria Press," 117, Harrow Road, Paddington Green, W.

PUBLIC SALE
ON MAY 10 AND 11,
OF A
COAL-TAR DISTILLERY
SITUATED AT AMSTERDAM.

THESE Works are completely arranged for the distillation and working up from 10,000 to 15,000 Tons of Coal Tar, and are capable of a further enlargement to 20,000 Tons a year.

They are situated on the Wetering Canal between the Amstel and the Y, and are accessible for Ships and Barges with a draught of about 8 feet.

The Superficial Area is about 15,000 square metres, very favourably situated within the limits of the Commune of Amsterdam.

For further Information, inquiries to be addressed to THE SOCIETY OF CHEMICAL INDUSTRY, Frederiksplein 5, AMSTERDAM.

During the Year 1898, Contracts are open at different Gas-Works in Holland for a quantity of about 16,000 Tons.

Creosote Oil for the preparation of Timber, much employed in this country, is protected by an import duty of fl.5 per ton.

N.B.—About 9000 additional square metres of Land adjoining can also be purchased.

Price 6*s., Cloth Bound,*

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By N. H. HUMPHRYS, Assoc M.Inst.C.E., F.C.S.

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Now Ready, Price 15*s., Limp Cloth, the*

SEVENTEENTH YEARLY

ANALYSIS OF THE ACCOUNTS

OF THE

METROPOLITAN WATER COMPANIES.

Compiled and arranged by

ALFRED LASS, F.C.A.

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"OTTO" TYPE GAS-ENGINES

$\frac{1}{2}$ H.P. to 20 H.P. Specially designed for Users of Small Power.

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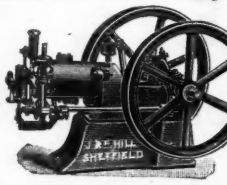

Gas-Engines and Pumps.

High-Class Workmanship.

J. & P. HILL,
Backfields & Norfolk Iron-Works,
SHEFFIELD.

NEWBATTLE CANNEL.

Highest Results in Gas, & Excellent Coke.

QUOTATIONS ON APPLICATION TO

THE LOTHIAN COAL COMPANY,

LIMITED,
NEWBATTLE COLLIERIES,
DALKEITH, N.B.

BOLDON GAS COALS.

ANALYSIS.

Yield of Gas per ton	10,500 Cubic Feet.
Illuminating Power	16·9 Candles.
Coke	66·7 Coke.
Sulphur	0·86 Sulphur.
Ash	2·04 Ash.

For Prices, &c., apply to

W. H. PARKINSON,
THE HARTON COAL CO., LTD.,
NEWCASTLE-ON-TYNE.

Telegraphic Address: "PARKINSON NEWCASTLE."

INCANDESCENT GAS LIGHTING

Has now gained a complete and final **Victory** over its last and greatest Enemy

VIBRATION,

BY MEANS OF

CLAY'S PATENT

SHOCK-PROOF

Incandescent Burner Fittings

Of which full Particulars may be had from

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BOLTON, ENGLAND.

Telegrams: "CLAYS, BOLTON."

See "JOURNAL OF GAS LIGHTING," July 7, 1896, p. 19, and Dec. 21, 1897, p. 1365.

London Representatives: Messrs. Henry Greene & Sons, 153 & 155, Cannon Street, E.C.

GAS PURIFICATION BY
HYDRATED OXIDE.

THIS Material is of full Strength, and Exceptional Activity. It is specially prepared to minimize Back-Pressure; and will be supplied on Hire, or Sold, on the most favourable Terms.

SPENT OXIDES containing Blue, also CRUDE FERRO-CYANIDE PRODUCTS, either PURCHASED or EXCHANGED for FRESH OXIDE.

MANCHESTER OXIDE COMPANY, LTD.,
CANAL ST., MILES PLATTING, MANCHESTER.

HOLMSIDE

GAS COALS.

Present Daily Produce over 5000 Tons.

Latest Analysis—By CHARLES PHILLIPS, Gas Examiner to Rotherham Corporation

Yield of Gas per Ton	11,205 Cubic Feet.
Illuminating Power	$16\frac{7}{10}$ Stand. Sperm. Candl.
Coke (of good & pure quality)	$13\frac{3}{4}$ Cwt. per Ton.
Sulphur	A little over 1 per Cent.
Ash	Under 1 per Cent.
Tar	163 lbs. (Avoir.) per Ton.
Ammoniacal Liquor	103 lbs. (Avoir.) per Ton.

HOLMSIDE GAS COALS are supplied to the largest Gas Companies in England and on the European Continent; London alone consuming about half the produce.

SOUTH MOOR

PELTON GAS COALS.

Present Daily Produce available 3000 Tons.

Of equal quality to the "Holmside" Coal, and also very largely used by many Gas Companies at Home and Abroad.

Both descriptions are shipped at Tyne Docks, and Dunston Staiths, River Tyne, also at North and South Docks, Sunderland.

These Coals may be bought through the Principal Merchants in England, or direct from

MR. MARK ARCHER,

HOLMSIDE & SOUTH MOOR OFFICES,
NEWCASTLE-UPON-TYNE.

HEBBURN MAIN GAS COALS.

Yield of Gas per ton . . . . . 10,500 cub. ft.
Illuminating Power . . . . . 16·4 candles.
Coke . . . . . 68 per cent.

For Prices, f.o.b. Ship or Delivered by Rail, apply to

THE WALLSEND & HEBBURN COAL COMPANY, LTD.,
8 Lombard Street,
NEWCASTLE-ON-TYNE.
W. RICHARDSON, Fitter.

FIRE-BRICKS, FIRE-CLAY, & FURNACE CEMENT.

THE
FURNACE FIRE-BRICK CO., Ltd.
(Late JAMES WHITE & CO.)
WORKS:
Longcliffe, near Wirksworth, Derbyshire.
MANUFACTURERS OF
HIGH-CLASS FIRE-BRICKS, acknowledged to be the best obtainable for
GAS, IRON, AND CHEMICAL FURNACES.

For Analysis and Prices, address—

JAMES WHITE & CO.,
WIDNES, LANCASHIRE.

Telephone: Castleford No. 214. | Postal Address: Castleford.
Telegrams: "Silkstone Castleford."

THE SILKSTONE & HAIGH MOOR COLLIERIES, LTD.

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Steam, Manufacturing, & Gas Coals & Cannel.
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FOR

GAS PURIFICATION,

For use in the
RECOVERY OF SULPHUR,
ALSO
Removal of last Traces of SULPHURETTED HYDROGEN in catch position.

Full Particulars on application to the Patentees:

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— *LIMITED,* —
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UNEQUALLED.

Gas Companies are solicited to try Samples of the

MIRFIELD
BLACK BED GAS COAL.

Prices and Analysis on application.

MIRFIELD (GAS-COAL) COLLIERY COMPY.
RAVENSTHORPE, NEAR DEWSBURY.

LONDONDERRY GAS COALS

FROM THE

MARQUIS OF LONDONDERRY'S COLLIERIES,

COUNTY OF DURHAM.

Available output up to 5000 tons per day.
Yield of Gas 11,000 cubic feet per ton of Coal as per analysis by Mr. John Pattinson, F.C.S., F.I.S.

FOR PRICES AND PARTICULARS, APPLY TO

S. J. DITCHFIELD,
SEAHAM HARBOUR, COUNTY OF DURHAM.

REGENERATIVE RETORT-SETTINGS.

J. FIRTH BLAKELEY & CO., GAS ENGINEERS AND CONTRACTORS, RAVENSTHORPE, YORKS,

Have made arrangements with Mr. ALEXANDER YUILL, of Alloa, N.B., for the SOLE RIGHT of BUILDING his REGENERATIVE FURNACES and SETTINGS OF RETORTS.
By Mr. Yuill's Principle, the maximum quantity of Gas per Retort per diem may be obtained with the minimum amount of fuel.
Gas Managers who are desirous of improving their Settings should ask for Particulars and Prices before adopting any other principle.
They give the best results, are reliable, and economical in construction.

GAS APPARATUS OF ALL KINDS SUPPLIED.

JAMES MILNE & SON, LTD.,

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60, HOLBORN VIADUCT, LONDON. | 111, ST. VINCENT STREET, GLASGOW. | 48, WELLINGTON STREET, LEEDS.

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PREPAYMENT WET AND DRY GAS-METERS.

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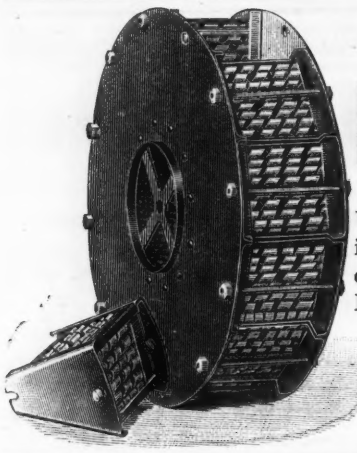
Manufacturers of MACHINE-MADE RETORTS and

FIRE-BRICKS of the highest Quality, made from Fire-Clay of a most Superior and Refractory Character, suitable for **GLASS-WORKS, GAS-WORKS, and BLAST-FURNACES.**

For Prices and Analysis, apply as above.



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IMPROVED WASHER-SCRUBBERS

We guarantee every Machine to extract 20 per cent. more of the Impurities contained in the crude Gas than may be required in the application for Tenders. Please defer ordering until you have seen our Patent Washing Devices fitted in Patent Cages. Prices quoted for Washer-Scrubbers or for Renewals to all Machines of the Kirkham, Hulett, and Chandler type.

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HUTCHINSON BROTHERS,

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Improved Wet & Dry Gas-Meters.

STATION-METERS. LAMP-METERS.

Test Gasholders and General Gas Apparatus.

Brass Main & Lamp Taps. Unions, Ferrules, &c.

The "Falcon" Lamplighter's Torch. Service Cleansers.

SYPHON AND OTHER PUMPS.

WOOD AND WROUGHT-IRON PURIFIER-GRIDS. SCRUBBER BOARDS.

WET AND DRY METERS REPAIRED.

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RETORT BENCHES ERECTED COMPLETE WITH OR WITHOUT SPECIAL FURNACES. RESULTS GUARANTEED.

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GAS ENGINEERS & CONTRACTORS FOR

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MR. MAURICE GRAHAM will be pleased to wait upon Engineers and Managers at their request.

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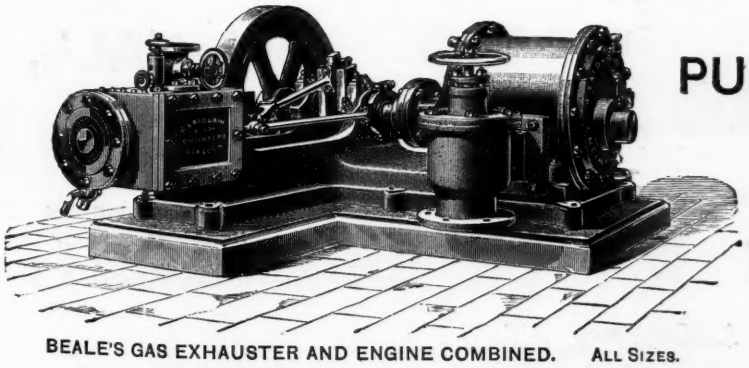

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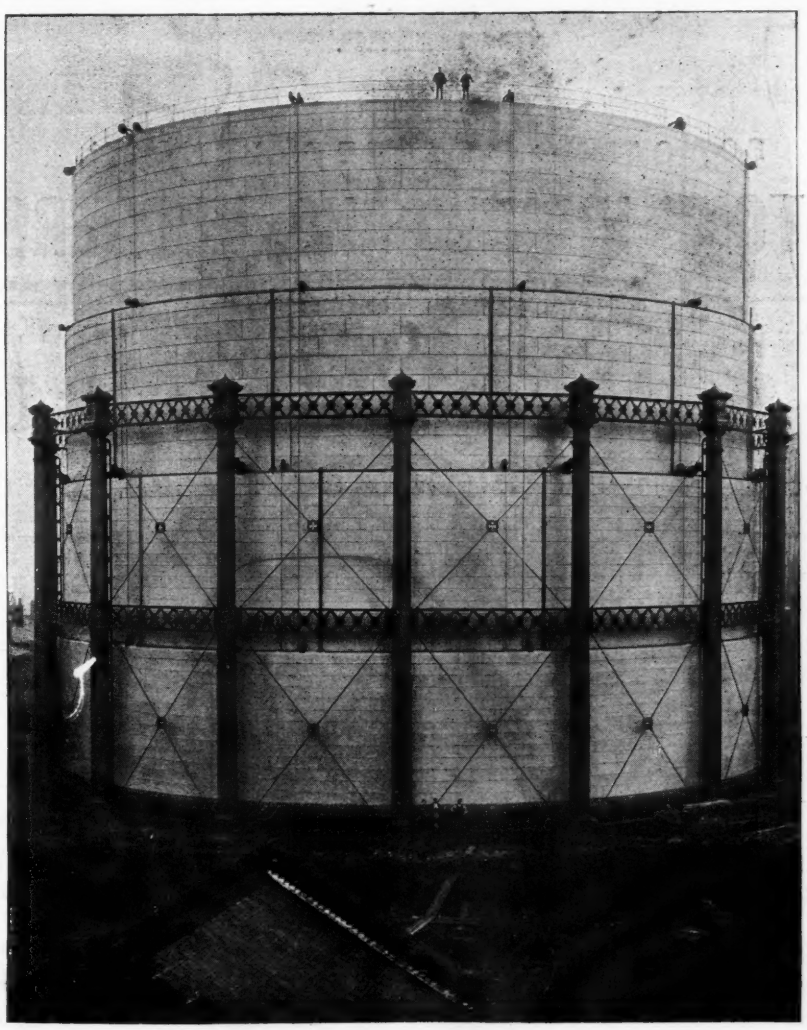

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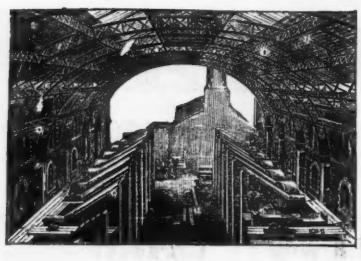

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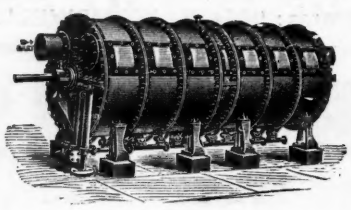

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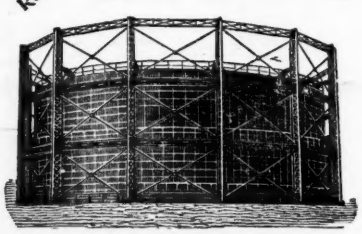

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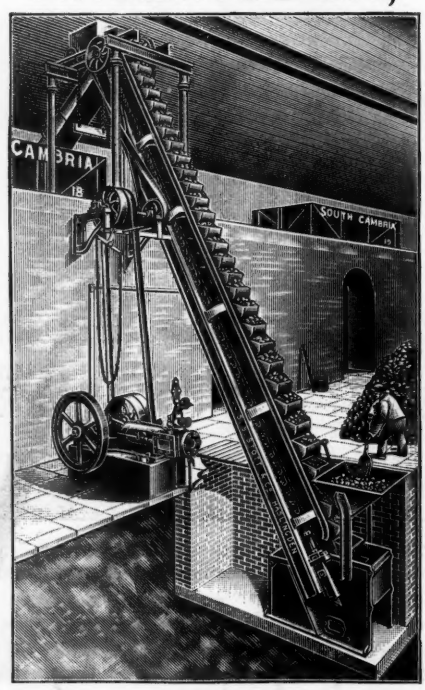

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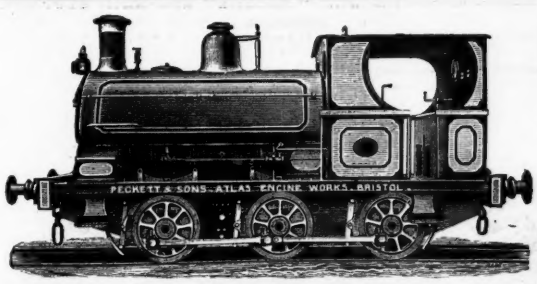

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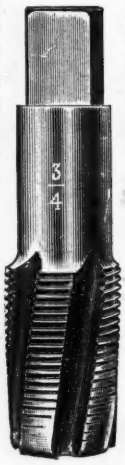

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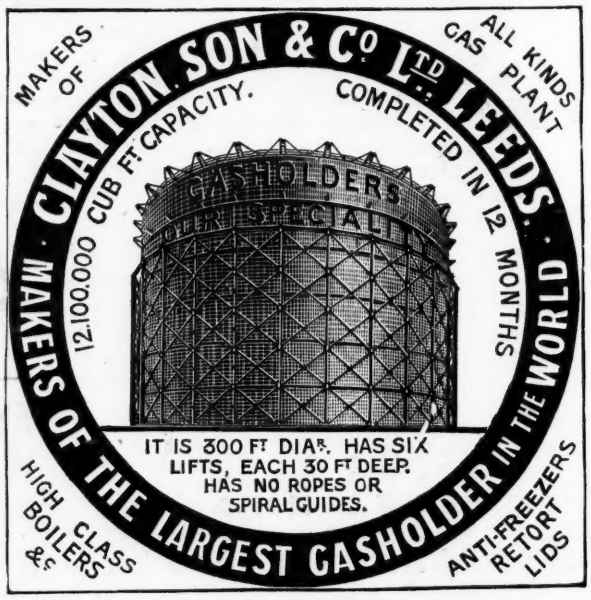
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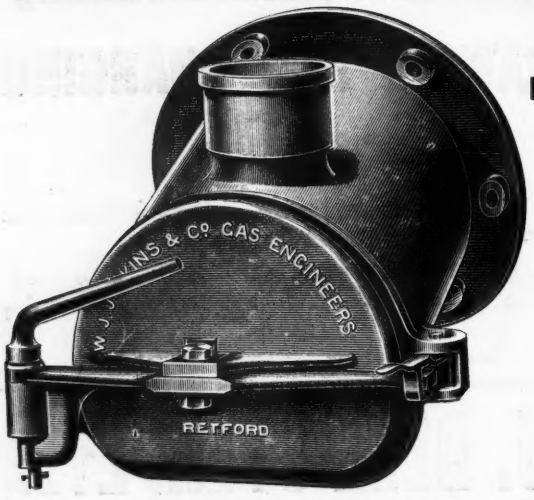

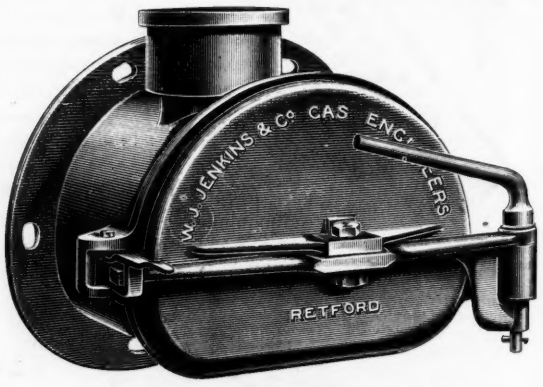

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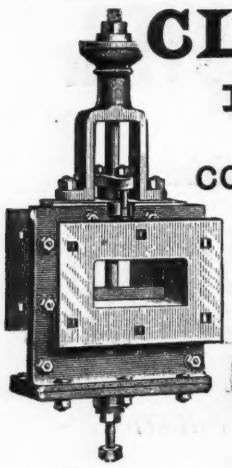

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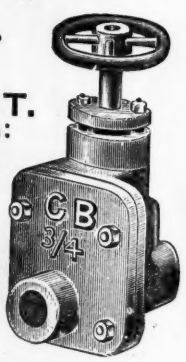

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